AN INTRODUCTION TO SCHOOL HYGIENE

W. B. DRUMMOND

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BY THE SAME AUTHOR

AN INTRODUCTION TO CHILD STUDY

Price $1.70 net.

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PREFACE

THERE are already a good many books on School Hygiene, but these differ greatly from one another. Some are written for school architects, some for doctors, some for teachers. Some deal chiefly with Physiology, some with Sanitation, some with Child Hygiene. This book is specially intended for teachers and students of education, and contains "what every teacher ought to know," according to my way of thinking, about the hygiene of the school-child. Of course, there are other things which some teachers ought to know. For these, special books may be studied.

I have omitted Physiology, not because I underrate its importance—I have already written a *Physiology* for teachers—but because when that subject is admitted to a book on Hygiene, it is apt to crowd the hygiene into a corner, and teachers who study such books are led astray into giving their pupils "health talks" on the valves of the heart or the contents of the abdomen. Sanitation I have admitted, but I have kept it in its proper place. A text-book on School Hygiene widely read by teachers devotes many pages to describing various forms of water-closets, but omits tuberculosis. I have reversed the process. Teachers can do a great deal towards diminishing the incidence of

tuberculosis, but as a general rule they have no say whatever in the provision of sanitary fittings. The truth is, as Professor Adams says, that the teacher's work begins with John. Now, everything which interferes with John's health, in school or out, interferes also with the teacher's work, and is therefore his concern. It is from that point of view, too often forgotten, that this book is written.

Although the book has not been written with an eye to examinations, any student who studies it in conjunction with the author's *Physiology* should be able to face with equanimity any paper based on the Board of Education Syllabus or the Syllabus of the Institute of Hygiene.

I desire to thank Dr. Isabella D. Cameron for reading the manuscript and for much helpful advice and criticism. For the use of illustrations I am indebted to Miss L. Hardy (for Figs. 5 and 31), and to Drs. Adamson (35, 37), Crowley (22), Fowler (32, 34), Hill (23), Lyster (46), Rose (38), Roth (8), and Thomson (2); also to the Board of Education, the Carnegie Dunfermline Trust, the Edinburgh Open Spaces Committee, the Edinburgh School Board, and various business firms.

W. B. D.

EDINBURGH,
February, 1915.

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AN INTRODUCTION
TO
SCHOOL HYGIENE

CHAPTER I

INTRODUCTORY

EDUCATION is the guidance of growth. Everything which interferes with a child's growth interferes with the work of the teacher, and is, therefore, his concern. If malnutrition, for example, causes arrest of growth, how can the teacher guide that which does not grow? Many years have passed since it was discovered that a very large proportion of school-children suffer from ailments and defects which interfere with their education, and threaten their future usefulness, and happiness, and success. Very little attention was paid to this until the interest of the country was awakened by Dr. Leslie Mackenzie's disclosures regarding the physical condition of the children attending the North Canongate School in Edinburgh. In connection with the inquiries of the Royal Commission on Physical Training (Scotland), Dr. Mackenzie examined a large number of school-children in Edinburgh, and Dr. Hay examined a similar number in Aberdeen. No less than 70·5 per cent. of the children examined in Edinburgh, and 45·7 per cent. of those examined in Aberdeen, were found to be the subject of some disease or defect. No doubt in

many cases the disorder noted was of a comparatively trivial nature, but a considerable proportion of children were suffering from diseases which rendered their exclusion from school imperative, both for their own sake and for the sake of their neighbors. Thus, both in Aberdeen and in Edinburgh children suffering from consumption were found attending school. The Report of the Royal Commission was published as long ago as 1907, but the figures quoted are of historic interest because this report had more influence than any other single factor in the inauguration of the existing service for the medical inspection of school-children. Recent statistics from all parts of the country tell the same tale as the figures which have been quoted. It is unnecessary to refer to them in detail. Suffice it to say, by way of example, that the latest report upon the medical inspection of school-children in Scotland (published May, 1914) shows that something like 10 per cent. of the children examined had defects of sight requiring attention, and that 1,489 cases of tuberculosis were discovered as the result of routine inspection of children in the year under review (1912).

Conditions such as these are important to the teacher, both because they interfere with his work and because schools are partly responsible for their prevalence. It is true, as might be expected, that the worst nourished children, and those amongst whom the highest percentage of disease is discovered, come from the poorest homes. But unsatisfactory conditions are not confined to elementary schools in poor districts. When we turn from the schools of the poor to the schools of the rich, what do we actually find? We take our answer from Dr. Dukes, who has published the results of his examination of 1,000 boys on their entrance to Rugby. These boys are a selected lot, not only because they have been abundantly provided from infancy with food and clothing and medical super-

vision, but because boys are not sent to Rugby unless their parents regard them as sufficiently strong and healthy to stand the rough and tumble of public school life. Dr. Dukes tells us that, on the whole, these boys were healthy-looking and well nourished. No cases of lung disease were discovered amongst them, but heart disease was present in ten instances. When we turn to the record of deformities, our attention is at once arrested by the extraordinary number noted to be affected. Lateral curvature of the spine was present in 445 cases, knock-knee in 526 cases, flatfoot in 329 cases, pigeon breast in 126 cases, bow-legs in 64 cases.

These are certainly surprising results, and especially when we read that "in no instances were slight defects registered, but only such as were of sufficient practical importance to the sufferer to need special attention at the hands of the drill-sergeant or the gymnasium instructor."

Now, what is the significance of these results? These deformities were all acquired. Most of them were due to faulty postures in school. That is to say, they were acquired—nay, induced—under the very eyes of the masters in the preparatory schools which the boys attended before their admission to Rugby at the age of from twelve to fourteen years.

Value of Hygiene to the Teacher.—These remarks are sufficient to show that the health conditions at present prevalent in schools are very far from being satisfactory, and it is evident that a knowledge of hygiene must be of direct practical value to the teacher. Such knowledge will be useful in the following ways:

1. To enable him to recognize conditions which interfere with his work. For example, inattention may be due to deafness; laziness to malnutrition or insufficient sleep; apparent stupidity to the presence of adenoids.

2. To enable him (*a*) to avoid the risk of injury to the pupils—the risk, for example, of nerve-strain from fine work at too early an age, of eye-strain from too much fine work at any age, of deformities from faulty postures; and (*b*) to minimize the risks associated with faulty hygienic conditions in school, such as defective ventilation.

3. To enable him to recognize cases requiring special medical or hygienic treatment, and to utilize to the best advantage of the children all available means—medical inspection, school nurses, school clinics, open-air schools and holiday homes, as well as means nearer to his hand, such as physical exercises, open windows, and the school playground.

4. To help him to look after his own health, not only for his own sake, but for the sake of his pupils. Few kinds of work are so quickly affected in quality by health as teaching. Nervous breakdowns are much too common among teachers, especially women teachers, and this implies that large numbers of teachers are teaching in a "state of nerves," which puts a great strain on the children as well as on themselves. Teachers who find their work fatiguing should learn how to utilize their week-ends for rest and recreation, and how to avoid multiplying unnecessary out-of-school work for themselves.

Again, consumption has a higher incidence among teachers than among other professional people. Hence a teacher suffering from a cough (or, indeed, from any ailment) should take care not to delay too long in seeking medical advice. For not only is consumption more amenable to treatment in the early stages, but a teacher suffering from the disease is a source of danger to the pupils.

5. To enable him to teach hygiene. Hygiene may be taught as a branch of science, for the purpose of training the reasoning powers; or it may be taught for the double purpose of improving the health of the pupils and developing hygienic habits. These ends are not incompatible, and

both ought to be sought. But, so far as the vast majority of elementary school-children are concerned, the teacher's efforts must be confined to the latter. There is no use attempting to teach "science" to children under twelve, or to "educe" conclusions which cannot be reached by childish ways of thinking, and the teacher who was told that "the weight of the earth is found by comparing a known mass of lead with an unknown mass of lead" only reaped what had been sown.

Informal hygienic training, however, is of the greatest value even in the case of the youngest children. Every teacher has it in his or her power to influence in a high degree the health conditions prevailing among the pupils, and that power is greatest where it is most needed—namely, in those schools where a considerable proportion of the pupils do not get that domestic training which should be found in every good home.

The defects which have been described as most frequent and important among school-children are the following: Uncleanliness, including pediculosis; enlarged glands; nasal obstruction; defective hearing; eye-strain; deformities (round shoulders, flat chest, spinal curvature); decayed teeth; poor nutrition; nervous exhaustion. All these conditions are exceedingly common. There is not one of them which it is not in the power of school teachers to diminish. This statement is not made on merely theoretical grounds, but is based on what has actually been accomplished by certain teachers. Uncleanliness, for example, may be a factor—I do not mean that it is a necessary factor—in the production of every one of the defects named. Uncleanliness of the skin and teeth leads to disease of the glands. Failure to keep the nose clean by the use of a handkerchief favors the development of adenoids, enlarged tonsils, and deafness. Eye affections are much more common in dirty children than in clean ones. Nasal obstruction, toothache,

and pediculosis interfere with sleep, and therefore with nutrition, thus predisposing to nervous exhaustion. Poor nutrition and weakness predispose to round shoulders and lateral curvature, and nasal obstruction predisposes to flat chest and affections of the lungs.

There is, therefore, no more practical method of teaching hygiene than by insisting on personal cleanliness. In a school in a poor district, where many of the pupils were in a dirty and neglected condition, a headmaster instituted an inspection twice daily. The morning inspection was a minute one, including hands, faces, ears, and necks. Children found wanting were sent to the lavatory to wash. The condition of the hair, clothing, and boots also came in for criticism. The result was such a marked improvement that quite a transformation was effected in the appearance of the children.

In Paris very strict rules are enforced with regard to cleanliness and the condition of the clothing. In the infant schools an inspection for cleanliness is made every morning. Every child must be provided with a handkerchief. Rents in clothes must be stitched up, and pins in place of a hook or button are forbidden.

Posture, mouth-breathing, and the chief causes of eye-strain are just as much under the control of the teacher as cleanliness. The teacher who attends to these things will not only help to promote the health of the children, but will incidentally give much more instruction in hygiene than could be conveyed by a course of formal lessons. The ventilation of the class-room, also, is usually under the control of the teacher, whose attention or want of attention to the state of the atmosphere cannot fail to impress children with the idea that fresh air is a thing that matters or a thing that does not.

The home-life of children may be greatly influenced by the hygienic training given in school. Young children are

such good ambassadors that a kindergarten may effect a general domestic improvement in a neighborhood; while older children are generally quite ready to practice hygienic rules which are not too troublesome, especially if they appeal to their judgment and promote their comfort. Between the training of little children in proper habits and the formal instruction which is suitable only for older pupils, there is room for the dogmatic teaching of hygienic rules which should be followed outside school, whether their scientific basis is understood or not. Many hygienic rules are followed by people in one section of society as a matter of course which are not followed by people in another because they never heard of them. Many children never learn at home that beds ought to be aired, or that mattresses should be turned, or that there are people in the world who take off all their clothes every night. If these children are not taught such things at school, they will probably never be taught them at all. There are many objections to imposing on children pledges of any kind, or rules of conduct which may be broken without detection, yet a voluntary pledge to abide by certain rules may often be a great help to right conduct. Many such codes have been drawn up, from the *De Civilitate Puerili* of Erasmus to the rules for the children belonging to the Children's Health Crusade published by the Women's Imperial Health Association.* The following rules, about which there is nothing novel, may serve as a basis for a pledge of healthy living.

So far as possible—

I will live on plain, wholesome food, and will take care to chew it thoroughly.
I will brush my teeth night and morning.
I will keep my skin, nails, and hair clean.
I will have a bath at least once a week.
I will try to have my clothes clean and in good repair.

* 7, Hanover Square, London, W.

I will try to have my bedroom window open at night.
I will breathe through my nose, and will practise taking a few deep breaths in the open air every day.
I will avoid reading bad print, and will not read or sew in a bad light.
I will avoid lazy and slouching attitudes, and will try to sit straight, to walk straight, and to live straight.

Other rules, of course, may be added—*e.g.*, with regard to spitting, coughing, plaiting the hair in the case of girls, smoking in the case of boys.

Although so much stress is laid on informal hygienic training, the value of formal instruction must not be underrated. Formal lessons in the laws of health should enter into the curriculum of every school-child—informal training should be there all the time. Formal lessons may advantageously, in the first instance, aim at giving rational explanations of hygienic doctrines which the children have already been taught dogmatically or of hygienic habits in which they have been trained. In other words, their aim should be to convince the reason at least as much as to increase knowledge. Such lessons would be much more useful than lessons in physiology of the ordinary kind. The laws of health are, no doubt, based on physiology, but the practice of hygienic living is no more based upon a *knowledge* of physiology than the art of cooking is based on a knowledge of organic chemistry. If the object of teaching hygiene in schools is to assist the children to live healthy lives, the teacher should be quite clear as to the distinction between hygiene and physiology. The educational distinction is the same as between nature study and botany or zoology. Nature study is of great educational value to children much too young to study botany as a science. In the same way physiology may be utilized to illustrate and explain hygienic doctrines and practices to children, but physiology as a science is not a very suitable subject for children in elementary or primary schools.

To sum up, the teacher may best teach hygiene *primarily* by taking advantage of his daily opportunities to train children in hygienic habits and to bias their minds in favor of cleanliness and fresh air and wholesome food—of 'pulse and water' rather than 'the king's meat'; *secondarily*, and at a later stage, by formal lessons whose chief aim should be to furnish a rational basis for what is already known and practised.

What is Being Done.—Enough has been said to show the need of more careful supervision of the health of school-children. Facts such as those recorded could be multiplied indefinitely, but there is no need; their importance is admitted, and provision for the medical inspection of school-children has been made by the Act of 1907. Since then much has been done, not only with regard to medical inspection, but with regard to arrangements for prevention and treatment, without which the utility of inspection would be very limited.

1. *Medical Inspection.*—In some places medical officers have been appointed to examine and supervise the children in a small group of schools, but in most places the medical inspector has charge of a large district, where he visits the schools at considerable intervals in order to examine as many children as possible in the shortest possible time. The children must be examined on the school premises and during school hours. The mothers of the children are usually invited to attend, and it is very desirable that they should do so, as this gives the medical officer an opportunity of advising directly regarding any points which require attention. It is necessary that the children should undress partially in order that a thorough examination may be made. It has been found that about twelve children can be examined in an hour, if care is taken that, as soon as the doctor has finished one case, another is waiting ready for examination. The results of the examina-

tion are entered upon schedules, on which probably the teacher has already entered the child's name, and some other particulars, such as age, height, weight, regularity of attendance, and the nature of any previous illnesses. As regards the frequency of the examination, a common plan is to examine all children on entrance, but without testing sight and hearing; again at about the age of eight, including sight and hearing; and again before leaving. This examination includes all the children, and not only those who appear weakly. This is a very important point, because experience shows that large numbers of children require medical treatment, although no suspicion was entertained that anything was wrong. The children examined fall into three classes—healthy, doubtful, requiring treatment. The number of the latter varies considerably, but Dr. Kerr found that of the children examined in London, about a third required treatment of some kind.

The plan of appointing one doctor to examine from ten thousand to twenty thousand children has the advantages of being economical, of securing considerable uniformity in the reports, and of facilitating the compiling of statistics. But as medical inspection is primarily for the benefit of the children, it would be better if it were carried out by doctors appointed to a small number of schools, which they could visit every few weeks, or even every few days, so as to keep in touch with the teachers, supervise the sanitary condition of the schools, and examine children specially referred to them, and keep an eye on children for whom treatment had been recommended. The school doctor should be experienced in the diseases of children, and should also be acquainted with the home conditions and have some knowedge of educational aims and methods.

2. *The School Nurse.*—Many affections found on inspection need treatment of a simple kind, such as can be

carried out by the parents, with or without a little assistance. Hence the appointment of school nurses has been found of great advantage. The nurse can supervise the cleanliness of the children, explain to parents the recommendations of the doctor, and assist in carrying out measures of treatment either in the homes or in special treatment centres. She might also act as attendance officer, as absence is usually due to illness.

3. *Treatment Centres or School Clinics.*—When the Act of 1907 was passed, it was apparently expected that children found in need of treatment would be attended to by the means then available—private practitioners, hospitals, dispensaries, and the poor law. It was soon found, however, that the resources for treatment were inadequate to the demand. This was not solely due to the large number of the children found to require treatment, but to the fact that large numbers of children were the subjects of chronic ailments, which needed daily treatment for a prolonged period. A child with "running ears," for example, should have the ears syringed daily, or twice daily, for months. A doctor will advise such treatment, but he has not time to carry it out. Hospitals could not provide such treatment without increasing their staff, and often there is no hospital near the school. The parents in many cases will not take the trouble to persevere with treatment which does not bring about a rapid cure. The result is that such cases, and many of a like nature, are apt to be neglected at the cost of health and education. Such cases are now being provided for in many places by treatment centres, or school clinics, under the local Educational Authorities. The establishment of such centres has to be approved by the Board of Education, and parents may be required to contribute to the cost of treatment.

Advantages of School Clinics.—The chief advantages claimed for the school clinics are that they provide treat-

ment for large numbers of children who otherwise are not treated adequately or are not treated at all. As the clinics are under the Education Authority, and their work confined to the treatment of school-children, they can co-operate with the schools as hospitals cannot. There is thus no loss of time between inspection and treatment; an attendance register can be kept at the clinic, and children who fail to appear at their time for treatment can be followed up. The last point is important, for hospital cases very often relapse owing to irregularity of attendance. It is also claimed that school clinics have social and educational advantages as a focus of interest for parents, doctors, nurses, teachers, and patients. The school clinic is also a centre where doubtful cases can be more thoroughly examined than is possible at the routine inspection in school, where the doctor has to examine a number of cases in a given time. Difficult cases have, therefore, to be noted for more leisurely examination later. Special kinds of work can also be undertaken, such as the prescribing and fitting of spectacles.

The Kind of Work Done.—Some idea of the kind of work done may be formed from the following statement regarding a clinic opened in Edinburgh on January 16, 1913. The premises comprise: Ground-floor—waiting-room, store-room, and kitchen; first-floor—dental operating room, dental waiting room, general room for work of nurses; second-floor—two rooms, one a dark room for ophthalmic work. The number of attendances till the end of July was 5,251, as follows:

Dental treatment	1,644
Defective vision	993
Fitting spectacles	672
External eye diseases	1,680
Ear disease	221
Skin disease	41

At most clinics spectacles are supplied at cost price (from 1s. 6d. to 3s. 6d.). In Edinburgh spectacles were supplied in 635 cases on condition that they were to be paid for by the parents; in 52 cases they were given free.

Arrangements should be made for continuing the treatment of chronic cases during the holidays, otherwise a good deal of the effort expended upon them will be found in many cases to have been thrown away.

4. *Special Schools.*—Many children who are incapable, for health reasons, or from some defect, of following the work of an ordinary school, benefit greatly by the care and training provided by special schools. Some of these are residential, such as the schools which have long existed for the blind and the deaf and dumb; some provide for the children during the day, but send them home for the night, such as many of the recently opened schools for cripples and mentally defective children. Open-air schools, residential and non-residential, have been started in various places for delicate children. Some of these special schools will be referred to elsewhere in this book.

CHAPTER II

THE STUDY OF CHILDREN

THE teacher should cultivate the habit of observing children individually, and forming an estimate of their physical condition. Amongst facts which may easily be observed in class are some of those noted in the schedules used for noting the results of medical inspection. Some practice in observation may be obtained by answering the following queries with regard to each child:

Complexion—ruddy (R), medium (M), or pale (P)?

Health Appearance—good (G), medium (M), or bad (B)?

Brightness or alertness—good (G), medium (M), or bad (B)?

Nutrition—stout (S), medium (M), or thin (T)?

Other queries easily suggest themselves: the *hair*—luxuriant and glossy, or thin, harsh, and dry; *cleanliness*—good, medium, or bad (with reference to hair, skin, and clothing); *energy*—is the child active and fond of vigorous play, or languid, easily tired, and inclined to sit about during recess?

Systematic observation of this kind is invaluable for cultivating the teacher's power of observation, and increasing his appreciation of the bearing of health upon the educational capacity of the child. But the results of such observations ought not to be scheduled and used for scientific purposes. For scientific work such data are of no value, not only because many teachers are not accurate observers, but because the terms (brightness, cleanliness,

etc.) are not exactly defined. On the other hand, the teacher's observations may be of immediate practical utility. The teacher may assist the doctor by picking out cases which obviously require medical treatment, and by observing whether treatment advised by the doctor is being attended to, and is having the desired effect.

Observations requiring more or less exact tests may also be made by the teacher, such as the preliminary testing of sight and hearing, so that the worst cases of defect may be the first to receive attention.

School Anthropometry.—Measurements of school-children are usually taken for statistical or medical purposes. To restrict the taking of measurements to such purposes is a waste of educational opportunity. Every school should have a weighing-machine and a measuring standard as part of its educational apparatus; for what purpose can best be illustrated by referring to what is actually done in a particular school. Mr. Mawbey, headmaster of Wix Lane London County Council school, tells us, in a published paper, that the heights and weights of the pupils can be taken monthly without loss of study time. The first morning period of twenty minutes for physical exercises in each month is set apart for the purpose, and is found to be ample. These routine measurements stimulate the boy's curiosity, and awaken a desire to learn and apply the arithmetical processes required in dealing with weight and measure calculations. The use of both metric and standard units make it as natural for the children to think in centimetres as in inches, in kilos as in pounds. Fractions and decimals, averages and percentages of age against age, form against form, assume a high degree of interest. The registration of their own measurements on graphic charts renders the scholars familiar with graphic arithmetic.

From the point of view of hygiene this monthly recording of measurements is of great value, for it is found to

awaken the interest of the boys in health, food, exercise, and physical development, and to arouse intelligent inquiry into the laws of health. Moreover, the graphic charts interest the parents, and in some cases lead to greater attention being paid to the nutrition and state of health of the boys.

Height is measured with a height standard, and the boots should be removed. Care must be taken to see that the child is standing quite erect, with feet together, looking straight forward, and with the back of the head, shoulders, and hips in the same vertical plane.

Weight should be measured with a weighing machine of the steelyard type. The spring balance type of machine is expeditious, but is not reliable, and is not recommended even by the makers. For ordinary school purposes weight is taken with the ordinary clothes on, but without boots. For scientific purposes the weight should be taken without clothes. The plan of subtracting a supposed average weight of clothes does not give accurate results. If a child is weighed frequently in order to detect a suspected loss of weight, care must be taken that the same amount of clothing continues to be worn, and the weighings should also take place at the same time of day, as there is a considerable diurnal variation.

Chest Measurement must be taken by means of a tape-measure applied directly to the skin. The child should stand erect with the arms hanging loosely by the side. The measurement should always be taken at the same level, which may be either above or below the nipple, and care must be taken that the tape is horizontal all the way round, and that the chest is not unduly inflated. The lower level is the better when it is desired to measure the expansion of the chest. For this the child must draw as deep a breath as he can, the tape being in position. When the measurement has been noted, he must expel as much

breath as possible, the tape being tightened up as the chest diminishes. In young children there is often very little chest expansion, partly because respiration is normally abdominal, partly because the child may not know how to draw a deep breath.

Vital Capacity is the amount of air a child can expire after taking as deep a breath as possible. It is regarded as a measure of respiratory power. It is obtained by means of an apparatus called a "spirometer." This is like a small gasometer, into which the child has to blow. A separate mouthpiece should be provided for each child, and these mouthpieces should be sterilized after use by boiling them for a few minutes.

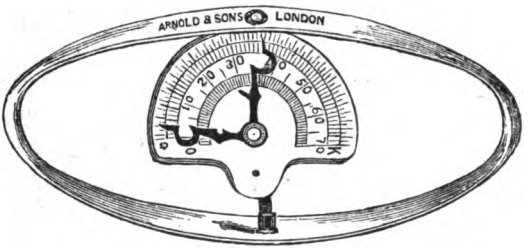

FIG. 1. Dynamometer.

Muscular Power is tested by the dynamometer, an oval steel spring which is compressed by the hand. A pointer indicates on a scale the strength of the grip. In Dr. Hay's dynamometer, designed specially for testing children, the compression of a rubber ball raises a column of mercury against a scale.

Some Facts regarding Growth.—Healthy children should increase steadily in height and weight. Any failure to do so is rightly regarded with anxiety. Race and heredity have a powerful influence on the rate of growth and the ultimate proportions attained. In any given community individual differences are considerable if we compare the

extremes met with; but by weighing and measuring large numbers, standards of normal or average height and weight for each age are obtained, to which normal children approximate very closely. The standard measurements for British children have been ascertained by the Anthropometrical Committee of the British Association.

The chart on p. 19 shows, by the varying steepness of the lines, that the rate of growth is not quite uniform. It is most rapid in infancy, as the weight trebles and the height increases by nearly one-half during the first year. There is usually a slight acceleration of the rate of growth at the age of six, and a much more marked acceleration begins at about eleven. The latter starts sooner in girls than in boys, and the chart shows that the average girl is taller than the boy at twelve, thirteen, and fourteen, and heavier at thirteen, fourteen, and fifteen.

This latter acceleration of growth is of great interest to the teacher, because it indicates the beginning of adolescence, a period characterized as much by rapid mental development as by physical increase. The earlier years of childhood should be devoted to the training of the senses, the formation of good habits, the cultivation of the motor functions, including speech, and the teacher may then appeal to the imagination and make considerable demands on memory; but adolescence is recognized as the period for the cultivation of the higher mental powers.

This rapid growth makes a great demand upon the energies of the individual. In many cases this demand is met so well that health distinctly improves, but on the whole the period is one of increased liability to sickness. This is particularly the case with the girls, and the age-period fifteen to twenty is the only five-year period during which female mortality is higher than male. According to Geddes and Thomson, the essential difference between the sexes is that man is an energy expending, and woman

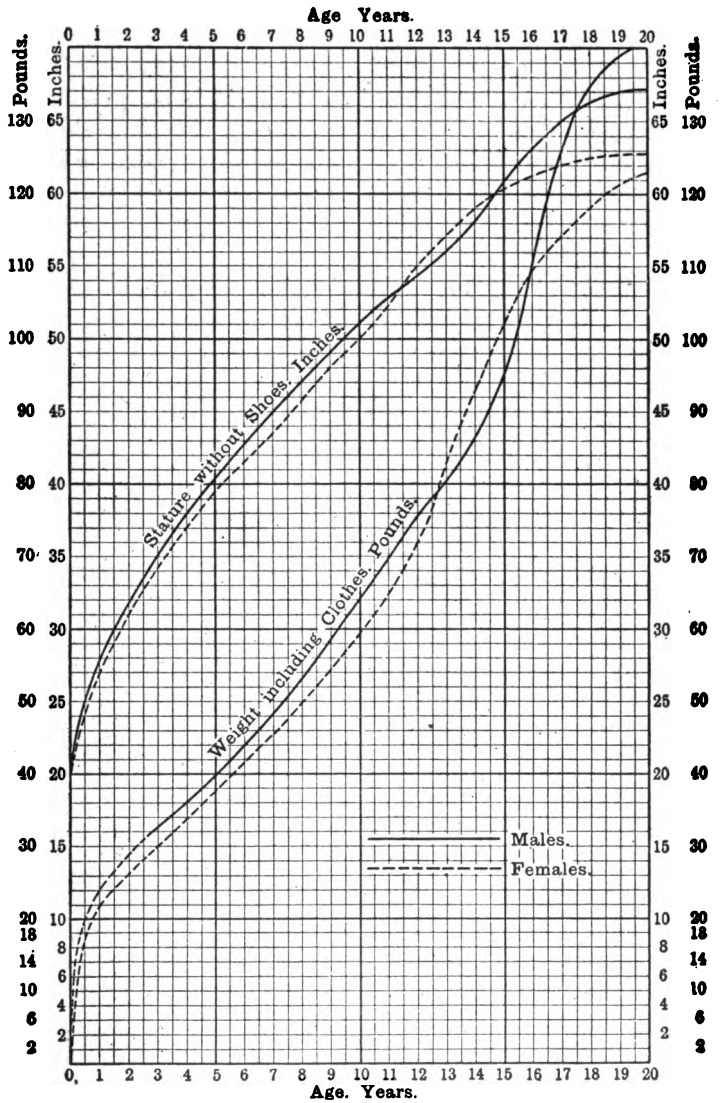

FIG. 2. Chart showing Rate of Growth at Different Ages.
(Note where the girls outstrip the boys.)
After Royal Commission on Physical Training.

an energy conserving, animal. It is during this period that these differences become pronounced. Hence, an amount of physical exercise and hard mental application which is essential to the well-being of average boys would involve a harmful degree of strain in the case of a large proportion of girls. Such facts tell against co-education after the beginning of the adolescent period.

The Ages of a Child.—By the age of a child we generally mean the length of time he has lived. But all people do not live at the same rate. Some grow old before their time. Nor do all parts of a child's nature always keep pace with one another. In school-life other ages are often of greater importance than the chronological, and the teacher should be acquainted with them. The following ages may be recognized:

1. *Chronological.*—The age in years.

2. *Physical.*—The age to which the physical measurements correspond as compared with the average. If a child of ten had the physical measurements of an average child of seven, his physical age would be seven. It has been suggested that physical age might be determined more accurately by the development of the bones, as shown by X-ray examination, but such a method is scarcely likely to become available for school use. Physical age is of great importance in the grading of children for gymnastics and sports, as well as in other ways.

3. *Physiological.*—Indicating the degree of maturity. At fourteen one boy is a young man, another is still a child.

4. *Mental.*—The intellectual level to which the child has attained. In the case of children under thirteen, this may be determined by the Binet tests.* M. Binet arranged a scale of five tests for each age, which average children may be expected to pass, for they are based upon a large

* See *Mentally Defective Children*, by Binet and Simon (Longmans, N. Y.).

number of observations. If a child of seven can pass the tests for five years of age, but not those for six or seven, his mental age is five. As an indication of the nature of the tests, those which a child of seven should be capable of may be given briefly. They are as follows: (1) Can count thirteen pennies; (2) can *describe* pictures—not merely enumerate objects in them; (3) notices omissions of parts from drawings of incomplete figures; (4) can copy diamond; (5) can name four colors shown. The tests are specially useful in cases where a child is suspected of mental deficiency, because he is very backward in school work. If such a child can pass all the tests for his own age without any assistance, he is intelligent, and his backwardness is not due to mental deficiency.

5. *Pedagogical.*—The number of years a child has attended school *or* the standard of instruction he has reached. Pedagogical age in the latter sense is closely related to mental age, but not necessarily so, for many factors besides intelligence affect the stage of instruction which a child reaches in a given time.

6. *Emotional.*—The stage of development indicated by the individual's attitude to literature, music, and art.

Some examples of divergences from the ordinary rate of development may be given.

John Wesley was fond of reading at the age of three. So, also, was Lord Macaulay, who began to write *A Compendium of Universal History* at seven. Southey began to write dramas before he was eight. A boy of fourteen is six feet in height, and broad in proportion. His physical age is at least twenty, his mental age about sixteen. On the other hand, a feeble-minded girl of sixteen is about twelve physically and physiologically, while her pedagogical age is scarcely two, for her educational accomplishments are less than that of many children who have been at school for only two years. These are exceptional cases,

but they differ only in degree from children to found in every school, to whom harm may easily be done if the difference between their physical, mental, and chronological ages is not recognized. Let it ever be remembered that "to travel deliberately through one's ages is to get the heart out of a liberal education" (Stevenson).

Tables.

Table I.—The following are the average heights and weights of British children of all classes at various ages, according to the measurements collected by the Anthropometrical Committee of the British Association:

I. Boys and Girls — Height and Weight.

Age	Boys.		Girls.	
	Height.	Weight.	Height.	Weight.
5	41.03	39.9	40.55	39.2
6	44.00	44.4	42.88	41.7
7	45.97	49.7	44.55	47.5
8	47.05	54.9	46.60	52.1
9	49.70	60.4	48.73	55.5
10	51.84	67.5	51.05	62.0
11	53.50	72.0	53.10	68.1
12	54.99	76.7	55.66	76.4
13	56.91	82.6	57.77	87.2
14	59.33	92.0	59.80	96.7
15	62.24	102.7	60.93	196.3
16	64.31	119.0	61.75	113.1
17	66.24	130.9	62.52	115.5
18	66.96	137.4	62.44	121.1
19	67.29	139.6	62.75	123.8
20	67.52	143.3	62.98	123.4
21	67.63	145.2	63.03	121.8

Tables II., III., IV., V.—These tables show the average heights and weights of Edinburgh Board School children, as compared with the British Association's standards. It

will be noticed that the latest measurements for both heights and weights average slightly more at nearly all ages than in 1907–1908—the year in which the medical inspection of school-children began.

II. Boys — Height in Inches.

Session.	Year:	5.	6.	7.	8.	9.	10.	11.	12.	13.
	Brit. Assoc.	41.0	44.0	46.0	47.1	49.7	51.8	53.5	55.0	56.9
1907–08	Edinburgh	41.1	42.4	45.0	46.8	48.9	50.7	52.3	54.3	56.3
1911–12	"	41.4	43.3	45.3	47.2	49.1	50.7	53.1	54.2	56.2

III. Boys — Weight in Pounds.

Session.	Year:	5.	6.	7.	8.	9.	10.	11.	12.	13.
	Brit. Assoc.	39.9	44.4	49.7	54.9	60.4	67.5	72.0	76.7	82.6
1907–08	Edinburgh	40.7	43.3	47.9	51.9	56.7	61.8	66.2	72.3	79.2
1911–12	"	41.1	44.5	48.3	52.6	57.0	61.4	66.9	72.1	79.3

IV. Girls — Height in Inches.

Session.	Year:	5.	6.	7.	8.	9.	10.	11.	12.	13.
	Brit. Assoc.	40.8	42.6	44.5	46.6	48.7	51.1	53.1	55.7	57.8
1907–08	Edinburgh	39.9	42.1	44.5	46.6	48.5	50.3	52.3	54.5	56.8
1911–12	"	40.9	43.0	44.9	46.9	48.7	50.5	53.1	54.7	57.8

V. Girls — Weight in Pounds.

Session.	Year:	5.	6.	7.	8.	9.	10.	11.	12.	13.
	Brit. Assoc.	39.6	42.4	46.7	52.2	55.5	62.0	68.1	76.4	87.0
1907–08	Edinburgh	39.4	42.1	46.1	50.3	54.6	59.2	65.0	71.8	80.5
1911–12	"	39.9	42.7	46.7	50.9	55.5	60.0	65.0	73.1	81.7

CHAPTER III

THE HYGIENE OF NUTRITION AND GROWTH

The Nutritive Requirements of Children.—Food, fresh air, and sleep are the fundamental necessaries of life. All others are secondary. In several respects the food requirements of children differ from those of adults.

1. Relatively to their size, children require *a larger amount of food* than adults. According to Atwater, the food required by a child of six to nine is 0·5 that of a man, by a child of ten to thirteen it is 0·6, by a girl of fourteen to sixteen it is 0·7, and by a boy it is 0·8.

2. Owing to their rapid growth, the *proportion of protein or tissue-building material* in their food must be greater. Lime and other salts are also of great importance, especially for the growth of bone.

3. Owing to their active habits, their food should *yield energy* easily and rapidly. The most valuable constituent of food in this respect is sugar, which may be regarded as a muscle food. In the natural food of infants, sugar forms more than 50 per cent. of the solid matter. The child's love of sweet things is not so much an acquired taste as the expression of a physiological need. Whether this need should be supplied by the consumption of "sweeties" is another question (*vide* p. 38).

4. Children lose heat with relatively greater rapidity than adults. Hence *fat is particularly valuable*, because no other food constituent gives off so much heat in proportion to its bulk. In the case of all children who are

thin, and all who suffer from cold, the diet should contain as much fat as can be digested easily.

5. Many foods contain certain *vital principles* of whose nature very little is known. If these substances are deficient in the diet, disease is liable to occur. Probably children have a greater need of such substances than adults. Vital principles are most abundant in fresh foods, and some believe that they are affected by cooking. Scurvy is a disease which is liable to occur in infants fed solely on proprietary infants' foods, or in sailors fed on salt meat. In either case the disease can be prevented or cured by including in the diet some fruit-juice—*e.g.*, grape-juice in the nursery, or lime-juice at sea.

Foods Suitable for Children.—*Milk* is the most important children's food, because it contains all the necessary constituents in suitable proportions, and in an easily digestible form. The proportion of protein, however, is a little greater than is necessary, seeing that children do not grow so fast as calves. For this reason it is usual to add a little water and sugar to the milk given to infants. In the case of older children, the same end is effected by including in the diet some foods which are poor in protein, such as rice or cornflour. Throughout childhood milk should form an important part of the diet. It is much better for children to drink milk at meal-times than to indulge in even weak tea or coffee. The chief objection to the free use of milk is that no other food is so liable to contamination. Indeed, it is safe to say that milk, as delivered at our houses, is never perfectly pure. The greatest danger lies in the frequent presence in milk of the tubercle bacillus, and of organisms capable of causing diarrhœa, and the less frequent presence of the infectious agents of various fevers. The danger is greatest in hot weather, because many organisms multiply rapidly in milk when the temperature is sufficiently high.

Milk should be delivered in sealed bottles, and should be as fresh as possible when used. It should be kept in a cold place and protected from dust. Before being given to infants or young children, milk should be sterilized; but older children, who are more resistant to disease, should have unsterilized milk, which is preferable as a food. The age at which children may be allowed to drink unsterilized milk must depend upon what guarantee one has that the milk is reasonably pure. During a spell of very hot weather it is often wise to stop the use of fresh milk, even sterilized, and to give the children temporarily condensed milk, or preferably dried milk ("Glaxo").

Eggs, like milk, contain all the constituents of a complete diet in an easily digestible form. They add greatly to the nutritive value of a milk pudding.

Peas, *beans*, *lentils*, and *oatmeal*, are all rich in protein and mineral salts. They are therefore amongst the most valuable of foods for children. They are also amongst the cheapest.

Meat is the principal source of protein in an ordinary diet. For young children, fish, chicken, and rabbit are preferable to red meat, which should be used sparingly (see also p. 31).

Bread is the chief source of carbohydrates in most dietaries. It contains about 50 per cent. of carbohydrate (starch), and about 6·5 per cent. of protein. It is thus very nutritious, but it is not, in itself, a perfect food. The proportion of protein to carbohydrate is too low. For this reason, wholemeal bread and standard bread are sometimes warmly advocated as being more nutritious. This is true, but the difference is slight. Perhaps the most nutritious of all breads is Hovis, which contains the germ of the wheat. The proportion of protein in Hovis is about 9·5 per cent. Bread is rarely adulterated, but a good deal of white bread is made from flour which has

been bleached by nitrous oxide fumes. The digestibility of flour so treated is believed to be reduced.

Bread should not be eaten new. New bread, when masticated, forms a tenacious mass which is difficult to digest, and some of which is apt to cling to the teeth. Crusts and crisp toast promote mastication, and children should always be taught to eat their own crusts.

Potatoes, *rice*, *cornflour*, *sago*, and *tapioca* are all very rich in starch, but poor in protein. *Oatmeal* and the *pulses*, which are rich in protein, are also rich in starch.

Sugar is best supplied along with pudding or stewed fruit.

Vegetables are wholesome, and aid digestion, but the nutritive value of most of them is low.

Fruits are good for children. They contain substances which enrich the blood, and their fibrous substance, if properly masticated at the end of a meal, helps to clean the teeth (p. 38). They should be eaten only when thoroughly ripe and in sound condition. Generally speaking, cooked fruit is more digestible than raw.

The Arrangement of Meals.—The proper times for meals depend chiefly on habit and custom. The traditional arrangement in Great Britain—a substantial breakfast, midday dinner, tea about 5.30, and milk and biscuits before bed-time—is a good one; but it is a mistake to imagine, as some do, that any other arrangement involves an infraction of the laws of Nature. Ample time should be allowed for breakfast and for attending to the bowels; violent exercise should not be taken immediately after a heavy meal; and supper, if taken at all, should be very light.

The Actual Feeding of School-Children.—Many investigations have been made as to the extent to which insufficient feeding prevails among school-children. Ac-

cording to Mrs. Pember Reeves,* the amount actually spent on food by poor families in Lambeth averages about 22½d. a day for the women and children. With wages at 18s. to 25s. a week, and a rent of 4s. to 8s., the amount could scarcely be more in families where there are several children. As it is estimated that 2,000,000 families in the United Kingdom exist on a wage of less than 25s. weekly, it is pretty safe to say that a considerable proportion of children attending the elementary schools get less than threepence worth of food daily. Is this sufficient, supposing the money to be spent in the most economical way? Mr. B. S. Rowntree has studied this question carefully, and his conclusion is that the minimum expenditure necessary to supply children with sufficient food is 2s. 3d. a week, as an average. Mr. Rowntree's dietary includes 1 pint of new milk daily, but no meat, except 1 ounce of boiled bacon three times a week. Nor does it include any jam, fruit, or other luxuries. It seems, then, that many men in regular work do not earn enough of money to feed their children properly. Of course, things are much worse when work is irregular, or money required for food is spent on drink. Moreover, school doctors all over the country complain that many children are ill-nourished because their mothers are too ignorant to spend their money wisely, or too careless to take the trouble to prepare it properly.

The Provision of School Meals.—The Education (Provision of Meals) Act, 1907, has conferred upon Local Authorities the power of providing meals for school-children whose parents are willing to pay, and for "necessitous" children free of charge. It may be admitted that this Act does not provide an adequate solution of the problem it deals with, the real remedy for which lies in the improvement of the home conditions. The public

* *Round About a Pound a Week* (Bell and Sons), 1913.

provision of meals for children who are suffering from partial starvation may relieve a symptom, but it does not touch the causes, except in so far—and the exception is important—as its execution may involve the better education of the parents of the future.

As school meals are intended primarily for the benefit of children who are suffering from malnutrition, it is evident that the meals supplied should be as nourishing as possible with due regard to economy. It is not sufficient that the meals should satisfy the appetite. Poorly nourished children have an even greater need of tissue-building foods than those who are well nourished, whereas they are probably fed largely on tea and bread—a diet defective in protein. Fat, too, is often insufficiently represented in a child's diet, for butter is expensive, and even margarine may require to be spread very thinly. Accordingly, school dinners must contain a pretty high proportion of protein and fat if they are to make up for deficiency in the quality, as well as in the quantity, of the food supplied at home. At Bradford it was found that two-course dinners which met these requirements cost about 1½d. each for the material used. In Edinburgh a number of one-course dinners were designed with the same end in view, partly because it was thought that a one-course meal would be more likely to be imitated in the homes of the children. These meals cost an average of 0·9d. for material—1d. for administration. The latter charge seems somewhat high in proportion, but only half the price we pay for a loaf is for the flour.

The Bradford dinners, which were arranged by Dr. Crowley and Miss Cuff, contained an average of 29 grams (1 ounce) of protein, and 18 grams (¾ ounce) of fat, which is about half the amount of each required daily by a child of ten. The other half would have to be made up by the other two meals, and this can easily be done if

breakfast consists of porridge and milk. Two ounces of oatmeal and half a pint of milk contain 18·6 grams of protein and 15·4 grams of fat. With such a breakfast and dinner, therefore, it would only be necessary for the third meal to contain 10·5 grams of protein and 2·6 grams of fat, which two fairly thick slices of bread and butter would do.

The fact that school dinners should contain a sufficient proportion of protein requires to be emphasized for two reasons.

Firstly, school dinners as actually supplied are frequently very deficient in protein. Even when the Bradford menus have been adopted, the school dinners have been found to be deficient, containing a certain instances only 20·6 grams of protein and 1·8 grams of fat.* The deficiency was due to the soup being too thin, and the pudding lacking in nutritive value.

One of the Bradford dinners is composed as follows: Lentil soup. Bread. Ginger Pudding and Sweet Sauce.

In such a dinner most of the protein is in the soup. As lentils contain rather less than 25 per cent. of protein, a dinner of soup alone would require 4 ounces of lentils in order to provide 1 ounce of protein. With bread and pudding as well, about 3 ounces of lentils would still be necessary, and this is sufficient to make a plateful of thick soup.

Secondly, the doctrine is being very warmly advocated in many quarters that the commonly accepted protein standard is too high. There is, indeed, a good deal of evidence that adults can not only live healthy lives on a vegetarian diet containing less than the standard proportion of protein, but may even surpass in endurance trained athletes who are living on a diet rich in animal protein. A vegetarian low protein dietary also suits many old people admirably. Such facts, however, ought

* Dr. Chalmers Watson, *British Medical Journal*, March 22, 1913.

not to be applied rashly to the case of children. The adult requires protein only to make up for wear and tear. Children require protein in order to grow, and any deficiency of protein must necessarily result in a stunting of growth. In contrast to those who uphold a low protein dietary, Dr. Dukes strongly advocates the use of meat twice a day. His advocacy doubtless applies chiefly to rapidly growing adolescent boys who are having a great deal of hard exercise.

The Energy Value of Food.—The amount of heat or energy which food is capable of furnishing to the body corresponds to the amount of heat it yields when subjected to complete combustion. This is measured in calories. A calorie is the amount of heat required to raise the temperature of 1 gram of water 1° C. This is the small calorie. In speaking of foods, the large calorie (usually written with a capital C) is employed. This is the amount of heat required to raise 1 litre of water 1° C. When we read in a diet table that the Caloric value of bread is 3, we understand that 3 grams of bread would yield on complete combustion sufficient heat to raise the temperature of 3 litres of water 1° C. A man requires about 3,000 Calories daily, and therefore, if he ate nothing but bread, he would require to eat 1,000 grams. Even apart from its monotony, such a diet would not be satisfactory, because it would not contain the different food constituents in their proper proportions. It is not possible to state exactly what these proportions are, because they are influenced by various circumstances, such as the digestibility of the food, or the amount of work being done. The following table shows the proportions approximately:

DIET FOR A MAN.

Protein . .	118 grams	(4.5 ounces), yielding	490	Calories.
Fat	56 "	(.25 ounces), "	470	"
Carbohydrate	500 "	(17.5 "), "	2,050	"
			3,010	"

When we know the dietetic requirements of an average child, both as to the number of Calories necessary and the suitable proportions of protein, carbohydrate, and fat, it is not difficult to arrange a dietary which will meet these requirements by referring to tables showing the energy value and the composition of various foods. A study of the tables appended to this chapter will make this quite clear. It is not necessary to pay attention to the proportion of salts, as any good dietary is sure to contain a sufficient quantity of these.

In framing a dietary many things have to be taken into account besides chemical composition. Some foods contain a great deal of indigestible material (*e.g.*, the skin and bones of fish); some which are entirely digestible theoretically are so indigestible in practice that only a very limited quantity can be assimilated (*e.g.*, cheese). The cost of food is also important. It is no guide to nutritive value, but is determined chiefly by the scarcity or abundance of particular foods. A pound of cod at 5d. contains just as much nourishment as a pound of sole at 1s. 6d.; a pound of margarine at 6d. yields as much heat and energy as a pound of butter at 1s. 4d. Some foods are sold ready for use; others involve the trouble and expense of cooking, and the risk of being spoiled by a bad cook. Dietaries, again, should make some allowance for individual differences. People differ not only in their preferences, and in their digestive capacities, but in their actual requirements. Of course, children should not be encouraged to be faddy about their food, for this is inconvenient to their elders; and most children can learn to like any food which they see others eat with enjoyment. But when children have a real hatred for particular kinds of wholesome food, as neurotic children especially frequently have, there is nothing to be gained by forcing them to consume food which raises their gorge. If some particular kind of food, such as fat, is needed, it is generally possible to find some form in which it can be taken readily.

Of beverages, water is best, and children should be allowed to drink water as freely as they choose, except for the purpose of washing down mouthfuls of food without proper mastication. Tea and coffee, even well diluted, should not be given to young children, nor to nervous children at any age. Milk and cocoa are the best substitutes, and both combine food with drink. The cocoas sold as "soluble" or "essence" should be preferred to cocoa "nibs," which may disagree owing to the large amount of fat they contain.

The Educational Aspect of School Meals.—No arguments are needed to support Robert Louis Stevenson's opinion that children should be taught "to behave mannerly at table, at least as far as they are able." But this is not always thought of. If school meals are provided, they should be made educational. They should be served in a "Christian sort of place," upon tables neatly laid and made pleasing to the eye with plants and flowers and shining silver—or what seems to be silver. The children should have their own appointed places, and there should be special tables for the little ones and for delicate children who need special attention. Though the cook may not be a *cordon bleu*, the food should be well cooked, and appetizing in appearance, and carefully served in suitable portions. It is not always possible to allow children to assist in the preparation and cooking of the food, though the educational advantages of such a plan are obvious enough. But some of the older girls should be appointed monitresses to wait at table and assist in feeding the younger children. A teacher will naturally superintend the whole arrangements, but it is usually possible, in the case both of the ordinary elementary schools and the "special" schools, to find ladies who will act as voluntary helpers, thereby saving the teachers from being called upon to take the duty too frequently.

Tables

The following tables have been compiled from Dr. Hutchison's book,* which is a mine of information on the subject of diet.

There are slight discrepancies in the tables. In reality the discrepancies between different samples (*e.g.*, of bread or cheese) are greater still.

	I.	II.	III.
Food.	Caloric Value — *i.e.*, Calories yielded by 1 Gram of Each Food.	Calories yielded by 1 Pound of Each Food.	Calories yielded by One Shilling's-worth of Each Food.
Butter	8.60	3,577	3,880
Oatmeal	4.15	1,879	11,274
Sugar	4.10	1,856	11,100
Rice	3.50	1,570	9,420
Peas	3.30	1,494	8,964
Bread	2.70	1,120	10,780
Cheese	2.40	1,303	2,638
Eggs	1.59	739	839
Beef	1.40	620	620
Potatoes	0.98	369	4,428
Milk	0.71	322	3,000
Fish	0.70	315	630
Apples	0.54	238	952

IV. Percentage Composition of Certain Foods.

Food.	Protein.	Carbo-hydrates.	Fat.	Salts.	Water.
Butter	1	1	82	6	10
Oatmeal	14.6	65.1	10.1	2.1	5
Rice	5	76	0.2	0.6	—
Peas (dried)	21	55.4	1.8	2.6	13
Bread	6.5	51.2	1	1	40
Cheese (Dutch)	30.8	1	17.8	6.3	32.9
Eggs	14.8	—	10.5	1	73.7
Beef	21	—	1.5	1	76.5
Potatoes	1.2	19	0.5	0.6	76
Milk	3	5	3.5	0.7	87
Banana	1.5	22.7	—	0.9	74
Apples	0.4	12.5	—	0.4	82.5

* *Food and Dietetics*, by Robert Hutchison, M.D. (Wood).

THE HYGIENE OF DIGESTION

Digestion begins in the mouth. All solid and semi-solid food should be thoroughly masticated before being swallowed. Even quite soft foods, like milk puddings, should be masticated until they are swallowed almost imperceptibly. Such mastication is necessary in order that the food may be thoroughly mixed with the saliva, by which starchy food is digested. The gastric juice has no effect upon starchy food. But if children are to chew food properly, they must be taught to do so; they must be allowed time; and they must have good teeth. Unfortunately, they are usually taught to hurry over soft food, which is erroneously supposed not to require chewing, and the condition of their teeth is shamefully neglected.

The Teeth.—A child's first teeth ought to remain white and sound until they drop out to make room for their successors. This first set consists of twenty teeth, the permanent set of thirty-two. The first permanent teeth to cut the gum are the first molars, which appear at six years of age. These are often mistaken for temporary teeth because they appear before any of the first teeth are lost. The time of eruption of the teeth of the permanent set is shown in the table:

At	6 years	4 first molars	32
"	7 "	4 central incisors	
"	8 "	4 lateral incisors	
"	9 "	4 first bicuspids	
"	10 "	4 second bicuspids	
"	12 "	4 canines	
"	14 "	4 second molars	
17–25	"	4 third (wisdom) molars	

It is strange that the teeth, protected as they are by the hardest substance in the body, are more subject to disease than any other organ. Yet so it is. From 80 to 90 per

cent. of school-children have decayed teeth, and this is a very serious matter, because it gives rise to an enormous amount of ill-health, which interferes with the child's progress at school, and often with attendance. Dental caries is believed to be due to the fermentation of starchy or sugary food which has lodged between the teeth, or become adherent to them. The fermentation is caused by microbes, and gives rise to acid, which attacks and softens the enamel. The microbes then invade the substance of the tooth, and, unless the dentist intervenes, the disease progresses until the tooth is destroyed. As caries

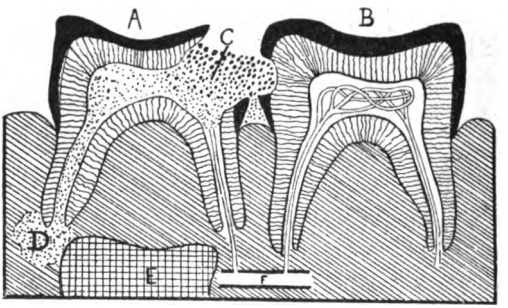

FIG. 3. Dental caries. *A*, Decayed tooth. *B*, Tooth showing early decay (dentine laid bare near *C*; pulp healthy). *C*, Fermenting food and germs. The pulp of *A* is infected, and a gum-boil is forming at *D*. *E*, Germ of tooth of second set. *F*, Artery in jaw.

is liable to spread from one tooth to another, it is important that carious milk teeth should be attended to, otherwise the permanent teeth are apt to be affected as soon as they appear. This is frequently the fate of the first permanent molars, all of which may already show signs of decay in children only seven or eight years of age.

The consequences of decayed teeth are numerous. Toothache, gum-boils, ulcerated gums, all give rise to pain and restless nights. Tenderness of the teeth interferes with mastication. Food is therefore bolted, and indiges-

tion results. Putrefactive processes in the affected teeth or gums give rise to poisons which are absorbed into the system. The tonsils become enlarged, the glands in the neck become inflamed, and the vitality may be lowered to such an extent as to render the child more liable to serious diseases. Doctors and dentists who are acquainted

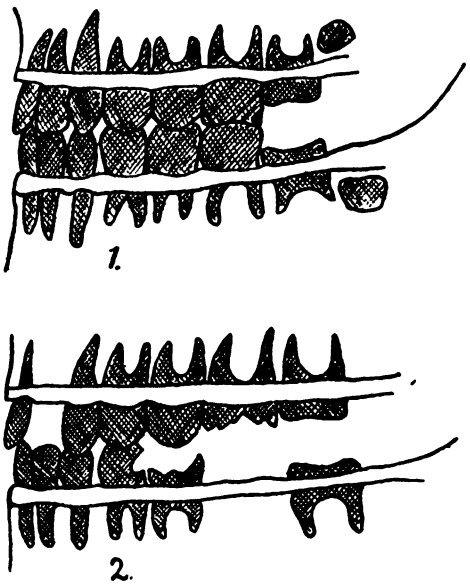

FIG. 4. Dentition at thirteen years of age. 1. Normal, all teeth sound, second molars just erupting. 2. Usual, two teeth absent, three decayed. Proper mastication of food impossible.

with the facts regard the prevention and treatment of dental caries as perhaps the biggest problem of child hygiene.

The Care of the Teeth. — Although many children are so predisposed to dental caries that the teeth decay almost as soon as they erupt, a great deal can be done in the way of prevention. This is a matter of education. Infants and young children should have plenty of milk, which

contains the salts necessary for the formation of sound teeth. When teeth appear, they should be used. The diet should not be so exclusively soft as it often is, but should include crusts, biscuits, and wholemeal bread. Raw fruit, such as apples, is excellent at the end of a meal, because the fibres of the fruit scour the teeth. Sugar is not harmful in itself, but the *practice* of eating sweets is harmful, because the sugar in a viscid form is apt to lodge in some crevice of a tooth and undergo fermentation.

Above all, the teeth should be brushed regularly and thoroughly. The children must be taught to work the brush up and down as well as backwards and forwards, and to brush the inner as well as the outer surface of the teeth. After brushing, the mouth should be rinsed out vigorously. Ideally this should be done after each meal. At least it should be done night and morning. The most important time is after the last meal at night, and on no account should the child be given sweets or biscuits after this final brushing. Tooth-brush drill is now sometimes carried on daily in school, and for children who are not taught to brush their teeth at home no lesson in hygiene can be more useful. The only objection to the practice is the danger of infection if care is not taken to see that the children do not exchange brushes. The brushes should be kept in a rack, not in contact with one another. Rack and brushes, when not in use, may with advantage be kept exposed to formaline vapour.

When caries has once begun, the teeth should be stopped by a dentist without delay. Teeth properly stopped in childhood may be quite free from decay forty years afterwards. For the purpose of arresting caries, and extracting teeth too far gone to be saved, school dental clinics have been started in various places. The first dental clinic in Great Britain was opened in Cambridge in 1906, and a number of new ones have been opened every year since.

FIG. 5. Practical hygiene in an Edinburgh kindergarten.

The Stomach and Bowels.—The *stomach* is an organ which is easily upset in many children, and teachers may often find opportunities to improve the occasion by warning children against unwholesome food. It is useful also to remember that vomiting is a common symptom in whooping-cough, and that an acute attack of vomiting is sometimes the first symptom of scarlet fever.

The *bowels* ought to be carefully regulated. *Constipation* is quite common in children, though less frequently met with in an aggravated form than in adults. It is apt to give rise to indigestion, flatulence, and colicky pains. Headache, fretfulness, and dulness may also be due to this cause. In treatment, the most important points are to train the child to regular habits and to regulate the diet. Brown bread, oatmeal, green vegetables, and fruit, are all slightly laxative. Drugs of a tonic nature are often useful, but the plan of administering a good dose of castor oil once a week is only likely to aggravate the condition.

Rupture, or *hernia*, consists in the protrusion of some organ, usually a piece of the intestine, into a weak portion of the front of the abdomen. It may occur at any age, and is much more common in boys than in girls. A boy suffering from the condition should wear a truss, and should not be allowed to strain himself. If the truss fails to effect a cure, an operation should be performed.

Diarrhœa in school-children is generally the result of some food that has disagreed, and the best treatment is to put the child to bed and administer a dose of castor oil. When the irritating food has been cleared out, the diarrhœa will generally cease. In nervous children diarrhœa may be brought on by excitement. Chronic diarrhœa may be due to tubercular disease of the bowels or some other serious condition, and therefore a careful medical examination should be made in order that the treatment may be suited to the case.

Incontinence, or want of control of the bowel, is more common in feeble-minded than in normal children. Still, it may be met with in young children mentally normal. It is usually due to want of training, poor health, and a nervous disposition. The treatment consists in proper training and attention to health. Punishment should not be resorted to.

Prolapse of the Rectum, commonly spoken of as "the bowel coming down," is a condition with which every infant mistress should know how to deal. It consists in the projection from the anus of a red soft swelling, which is simply the everted mucous membrane of the rectum. It is usually easy to push it back by gentle pressure with a soft cloth rung out of cold water.

THE HYGIENE OF NUTRITION AND GROWTH

Disorders of Nutrition.—A doctor, after examining a languid, poorly nourished child, declared reassuringly that there was nothing the matter. From the school point of view, however, there was a great deal the matter, for malnutrition may interfere with a child's education, mental and physical, more than many kinds of definite organic disease. Good nutrition is absolutely essential to normal growth and development. Growth depends primarily, no doubt, on race and heredity; but it depends also on factors extrinsic to the child—nurture factors, as they are called—such as food, clothing, housing, and environmental conditions generally. This is strikingly shown in the case of Glasgow, where 8 per cent. of the Board School children live in one-roomed houses. According to published figures, based upon measurements of 72,857 children, boys from one-roomed houses are, on the average, 11·7 pounds lighter and 4·7 inches shorter, and girls 14 pounds lighter and 5·3 inches shorter, than children from four-roomed houses.

Malnutrition interferes with education by retarding growth, by rendering children less capable of attending to their lessons, and by causing irregular attendance, ill-nourished children being remarkably liable to illnesses of all kinds.

Signs of Malnutrition.—Ill-nourished children are thin and pale, their muscles are soft and poorly developed, their hair is lacking in gloss. They are usually under-sized. The appetite is usually poor, and the digestion is readily upset. Sleep is often disturbed and restless, and at school the children appear languid, and their attention is apt to wander. Colds, chilblains, and skin affections are common.

Malnutrition may also be found in children whose home conditions are good. Such children, though very thin may be tall, and are alleged to have "out-grown their strength." They are often highly nervous, and are bright, even precocious, mentally. Their appetites are capricious. Sometimes they eat a great deal, but, as their mothers say, they "get no good of their food." Such cases often give rise to anxiety lest the malnutrition may be due to some undetected disease, especially tuberculosis.

As a general index of nutrition, weight is of much greater significance than height, because it is more variable, and much more influenced by changes in nurture conditions.

Rickets is a chronic disease of nutrition, due to faulty feeding in infancy, aggravated by unhygienic surroundings. It is very common in crowded districts, and chiefly affects children fed on bread or other starchy foods with an insufficient amount of good milk. The symptoms are most marked between the age of six months and two years. The development of the child is much retarded. Rickety children are late in teething and walking. They often suffer from convulsions and other nervous symptoms. They are very liable to colds and bronchitis. The most

striking feature of the disease, however, is the affection of the bones. These become thickened near their ends, and are at the same time comparatively soft, owing to a deficient deposit of lime salts. The result of this softness is that the bones bend easily, and deformities are produced.

In schools in poor districts a considerable number of children may be found in the infant department suffering from the effects of rickets. The acuter symptoms have passed, and the disease is in process of recovery, but the children still require care. These children may be recognized by their stunted growth and the existence of deformities. The head appears large in comparison to the body, and may be found on measurement to be really large, owing to thickening of the bones. The forehead is often somewhat square. The wrists may be thickened, but the most obvious deformities are seen in the legs, the most common being bow-legs, and a marked bending forward of the bones just above the ankle. The chest is usually poorly developed, and frequently is malformed. Deformity of the pelvis may also occur. In the case of girls this may be a serious matter in after-life.

Such children ought to have plenty of milk, and fatty foods, such as butter and cod-liver oil, are very beneficial. They should be out of doors as much as possible, especially in sunny weather, but it must be remembered that they take cold very easily. Owing to the weakness of their muscles, they are not able for much physical exercise; but they have great need of exercise suited to their strength, and especially of breathing exercises. They should never be allowed to sit in a strained position, nor in any position too long. Curvature of the spine may result from sitting without support, owing to the weakness of the muscles and ligaments of the back. Amongst common bad positions may be mentioned sitting with the arms folded, or sitting leaning on a desk, both of which tend to deformity

of the chest; and sitting on the floor with the legs crossed, which tends to bending of the leg bones.

Bloodlessness in young children is usually due to malnutrition or to some recent illness.

In older children a form of bloodlessness called *chlorosis* is very common in girls between fourteen and seventeen. It rarely occurs in boys.

The chief symptoms are shortness of breath on exertion, palpitation, attacks of faintness or giddiness, and constipation. The girls affected are not usually thin. They may even be stout. They are pale, or have a pink and white complexion. In bad cases the skin has a slight greenish-yellow tint, as is implied by the name "chlorosis."

These girls often ask to be excused from drill, owing to shortness of breath, or giddiness, or because they suffer from headache after it. Such cases should be under medical treatment, to which the affection is very amenable.

TEMPERANCE TEACHING

Many of the conditions which interfere with education are personal to the child, and for their relief the teacher must look to the doctor. But it should not be forgotten that a large proportion of the various morbid conditions which are so lamentably frequent amongst school-children are dependent upon the home surroundings. Only by a very narrow interpretation of the teacher's duties can it be held that teachers are not concerned with their pupils' life out of school hours. All social conditions which affect child-life inevitably affect the teacher's work. Amongst conditions of this kind there is none of greater importance than the prevalence of intemperance. It is beyond all question that a considerable proportion of the children who come to school physically, mentally, and morally unfit to take proper advantage of the instruction given,

owe their unfitness to the too free indulgence in alcohol on the part of a parent. Statistics prove that the amount spent on drink by working-class families averages six or seven shillings per week. Such expenditure means more than waste of money. It means that children are deprived of proper food. It means, in many cases, discomfort, dirt, quarrelling, disturbed sleep, a lack of all the comfort which should be found in a home. It is, therefore, incumbent upon the teacher to study the temperance problem; and this is the more important because, while there are great differences of opinion as to the influence of legislation on temperance, there is practical unanimity as to the value of education. During the last two generations an enormous change has taken place in the habits of the upper and middle classes with regard to drink. As this change is largely due to education, there is every hope that a similar change will gradually come about among the lower classes also. Teachers could do much to bring about such a change. This, at any rate, is the opinion of many people, including the medical profession, as is shown by the fact that a few years ago a petition in favor of temperance teaching in schools was signed by a large proportion of the doctors of the United Kingdom.

The Effects of Alcohol.—Only a brief summary need be given of the effects of alcohol.

1. *Alcohol is a stimulant.* It produces a feeling of exhilaration. In acute diseases it facilitates the work of the heart, and may tide a patient over a crisis. It is chiefly in such cases that alcohol is useful as a medicine.

2. *Alcohol is not a food.* Although alcohol is consumed in the body, more energy is dissipated than gained. The idea that alcohol is strengthening is therefore a fallacy. The trend of medical opinion is at present very much against the use of alcohol in the treatment of disease. This is very well shown by the following figures: In the

year 1890 the annual cost of wines and spirits per occupied bed in the Royal Infirmary of Edinburgh was 12s. 10½d.—10s. for spirits and 2s. 10½d. for wines. In 1908 the annual cost was 1s. per head for spirits, and nothing for wines. Similar figures could be given with regard to London hospitals.

3. *Alcohol is a poison.* It belongs to the group of narcotic poisons. The feeling of exhilaration which it produces is followed by depression. Large doses cause unconsciousness. A great danger attached to even a moderate use of alcohol is that it may excite a "craving" difficult to control.

4. *Alcohol does not "keep out the cold."* On the contrary, by bringing more blood to the skin, it lets out the heat. For this reason Nansen and other Arctic explorers have not permitted the use of alcohol during their expeditions.

5. *Alcohol diminishes working power.* Many experiments prove this. For example, compositors were found to set a smaller number of letters in a given time on mornings on which a small quantity of alcohol was given to them than on mornings when no alcohol was taken. The men experimented on thought they were working faster—an example of the delusive character of the sensations produced by alcohol.

6. *Alcohol diminishes endurance.* Sir Frederick Treves says of the relief column marching on Ladysmith: "In that enormous column of thirty thousand men, the first to drop out were not the tall men, or the short men, or the big men, or the little men; they were the drunkards, and they dropped out as clearly as if they had been labelled by a big letter 'D' on their back."

7. *Alcohol diminishes resistance to disease.* Alcoholic subjects are more liable to infection (for example, by tuberculosis) than teetotallers.

8. *Alcohol causes disease.* While free indulgence in alcohol gives rise to serious diseases, such as delirium tremens, insanity, and epilepsy, the habitual use of what many would regard as moderate quantities is responsible, directly or indirectly, for a vast amount of ill-health. Serious diseases of the stomach, liver, kidneys, and other organs, are frequently due to alcohol in persons who have never been drunkards. It has been estimated that about eleven thousand men and women at least die every year in England and Wales from diseases caused by alcohol.

Lessons on Temperance.—With regard to the kind of teaching which may be given to children of different ages, the reader must be referred to the Board of Education Syllabus on Lessons on Temperance.

"Temperance teaching in public elementary schools should aim mainly at impressing upon the scholars the manifest advantages of abstemiousness, and absence of advantage in, and the positive risks and dangers of, any departure from it. The advice or injunctions given should be based upon the broad facts of common experience such as children can readily understand, and upon the conclusions of trained observers (*e.g.*, as to the extent to which the power to do mental and physical work is affected by the consumption of alcohol in its ordinary forms) rather than upon the results of experiments or pathological studies."

Sir Victor Horsley describes an experiment which would be likely to interest children. Some cress is grown on cotton-wool in two saucers; one is watered with pure water, the other with water containing a little alcohol—say one part of whisky in fifty of water. The "teetotal" cress will be found to be much more robust and healthy than the other.

There are certain cautions which the teacher of temperance should bear in mind. All exaggerated state-

ments should be avoided, and the teacher should also avoid entering into any pathological details, or painting pictures of a horrible or repulsive nature. Highly colored diagrams of diseased livers and brains have been published for use in schools. Pictures of this description are not likely to be found effective aids to temperance teaching. A knowledge of the diseases caused by alcohol does not always save doctors from overindulgence! On the other hand, pictures or stories calculated to excite morbid curiosity or fear may do positive harm to nervous or emotional children.

CHAPTER IV

THE DAY'S WORK

THE education of a child is the education of the nervous system. All work done by children in school involves the activity of the nervous system. All the spontaneous activities of the child are dependent upon the nervous system. At the time the child goes to school the brain is growing rapidly, but it does not grow quite so rapidly as the body, so far as mere increase in size is concerned. In complexity of structure, however, it increases day by day in a most marvellous way. The nerve cells—three thousand millions of them!—send out little processes, which branch like trees and bring the cells into relationship with one another. Moreover, groups of nerve cells are brought into relationship with other groups by means of nerve fibres, and thus distant parts of the nervous system become connected together. The development of many of these connecting paths seems to be dependent upon their functional use. Function, we may say, makes structure. It is well known that different parts of the brain have different functions. One part is specially concerned with motion, one with sensation. The various special senses—sight, hearing, taste, smell—are *localized* in special parts of the cortex of the brain. The development of these areas depends upon their being called into action. Thus, if a child were kept in a dark room, the centres for sight would remain undeveloped. Without use, the centres for hearing would fail to grow.

Moreover, the various functions of the brain normally develop in a more or less definite order. Higher functions follow lower. The complex follows the simple.

Many of the functions of the brain depend upon the development of what are called *association paths*, by which one part of the brain is connected with another.

The development of a child's power to stretch out its hand and touch something it sees depends upon the development of such paths between the centre for vision in one part of the brain cortex and the centre for moving the hand and arm in another. Such a complex act as the accurate guidance of the hand by the eye is not acquired until the child has had a certain amount of experience in seeing, and has gained a certain control over its movements.

Now, if function in a sense makes structure, function is also dependent upon structure, and a recognition of this fact is of great importance for hygiene. Every change brought about by education, every fresh mental or physical acquirement, every new habit formed, every old habit overcome, involves a modification of the nervous system. Education is the guidance of growth and development, and these obviously require time. It is, therefore, both useless and harmful to try to force children along at more than a certain pace. It has been proved, for instance, that children who study a subject for a short time every day may make quite as good progress as others who are devoting to it twice as much time. A certain amount of time daily is necessary for the best progress, but time spent beyond that is wasted, because the brain will not grow at more than a certain pace.

Excessive exercise and premature exercise are not only a waste of time, but are also dangerous. All young structures, all growing organs, are delicate and easily injured. Any attempt to force the development of the brain, or any

attempt to develop functions prematurely, in advance of what the structural basis of function is able to bear, will be liable to disaster, in the form of nervous exhaustion or nervous breakdown of some sort.

Hygiene of the Nervous System.—The value of the child's work in school depends upon the healthy functioning of the nervous system. Mental and physical activities alike demand the expenditure of nervous energy. If this energy is to be well and profitably spent, account must be kept of the stage of development the child has already reached, of the nervous capacities already there.

A. *Play.*—The child's play is of great interest to the teacher, because it is not merely a relief from school work, but a means of exercising and developing function.

The games which children play spontaneously afford a valuable indication of what their nervous system is capable of in various ways. They learn in play to control their own movements, and acquire the art of coördinating various groups of muscles. They train their senses. They find exercise for their developing mental powers. A new light will be found to break on many school problems if the following questions are carefully studied:

1. At what games do children like to play at different ages?

2. What good (physical, or mental, or moral) do the children derive from these particular games?

B. *Work.*—We need not attempt to define wherein lies the difference between work and play, but even children realize that there is a difference; and while children gain a large part of their education through play, there comes a time when it is necessary to settle down to work in earnest. Schools are often blamed for insisting that children should "sit still," and "keep silence," and "pay attention," and when these things are insisted on too early or for too long a period, they are undeniably harmful. But in moderation

they are necessary and wholesome, and one should certainly avoid making school a place where, as a small boy said: "When we play we do not really play, and when we work we do not really work." The question how much brain-work, in the form of lessons, one may fairly expect of children is not easy to answer. Here is Dr. Duke's table:

Age.	Hours per Day.	Age.	Hours per Day.
5 to 6	1	10 to 12	4
6 " 7	1½	12 " 14	5
7 " 8	2	14 " 16	6
8 " 9	2½	16 " 18	7
9 " 10	3	18 " 19	8

C. *Fatigue.*—The most important problem connected with school work is presented by fatigue. Formerly the school day was devoted to long hours of continuous work, with little regard to rest or to other hygienic requirements. The result very frequently was the development of a condition now known as *overpressure*, which was first described by Professor Finkelnburg at the Congress of Hygiene at Nuremburg in 1877.

Since that date an enormous amount of labor has been devoted to the study of fatigue by testing children at different times of day, or before and after particular lessons, in order to ascertain to what extent they have been fatigued by the school work. The chief tests used have been the following:

1. *The Ergograph*,* an instrument invented by Professor Mosso for recording muscular fatigue.

2. *The Æsthesiometer*, an instrument with two metal points which can be separated from one another, the amount of separation being shown on a scale. If the two points are pressed on the skin close together they are felt as one point. To be felt as two points they must be separated about $\frac{1}{12}$ inch on the tip of the forefinger, $\frac{1}{4}$ inch on the tip of the nose, $\frac{1}{2}$ inch on the palm of the hand, 1 inch on the back of

* See the author's *Physiology*, chapter xiv.

the hand. As keenness of discrimination is influenced by fatigue, the æsthesiometer has been much used for testing the amount of fatigue produced by different lessons.

3. *The Arithmetic Test.*—This consists in adding up a long column of figures as quickly as possible for a definite period. The more fatigued the child is, the less will he be able to do, and the greater will be the number of mistakes.

4. *Visual Memory.*—A group of consonants is exhibited for a definite time—(*e.g.*, nine for twenty-five seconds), and the children tested are told to write down as many as they can remember in their proper positions. Several groups of letters are shown in succession.

5. *Auditory Memory.*—Consonants are pronounced at

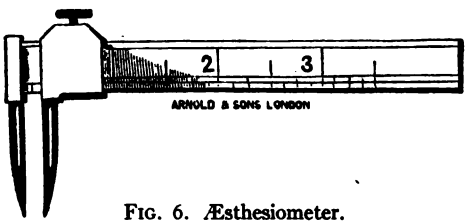

FIG. 6. Æsthesiometer.

a definite rate by the teacher, and the children are afterwards told to write them down in order.

All these methods have been very widely used. They are all open to many fallacies. The first two methods are chiefly useful for experiments carried out by skilled investigators. The arithmetic test has proved the most generally useful.

The Results of Investigations on Fatigue.—The problem of fatigue is an extremely complex one. It appears that fatigue is due to two causes—the production of a poison, and the exhaustion of nerve energy. It is possible that minute doses of the fatigue poison act as a stimulus, and this may in part explain the phenomenon of warming up to one's work. Large doses, on the other hand, may cause

serious injury. It has been proved by experiment that the time taken to recover from the fatigue of work done when we are tired is quite out of proportion to the time required to recover from the same amount of work done when we are fresh. It is thus educationally wasteful to force children to work when fatigued. On the other hand, the ability to resist fatigue can be increased. With this end in view children should be taught to work hard while they are at it, the periods of work being suited to the capacity of the child to resist fatigue.

The best length for lesson periods depends upon a variety of circumstances, but the following may be taken as a fair average:

6 to 9 years	15 to 20 minutes.
9 " 12 "	25 " 30 "
12 " 14 "	35 " 40 "
15 years and upwards	40 " 45 "

Much stress has been laid in recent years on the danger of too long lesson periods. Too little attention, perhaps, has been paid to the danger of too short periods (or too short terms), whereby the teacher may be tempted to crowd too much into the time at his disposal.

As regards the sequence of studies, the more fatiguing lessons, those requiring concentration of attention or effort of memory, should be taken in the forenoon. All new work comes under this head. Reading, dictation, and arithmetic are fatiguing subjects for young children, mathematics and languages for older children. Subjects which require good light, such as sewing, writing, drawing, should be taken in the middle of the day, especially in winter. The afternoon should, so far as possible, be reserved for subjects of a mechanical or recreational nature —*e.g.*, practice in arithmetical methods already known, nature study, hand work, singing. Liability to fatigue is also influenced by the season. Most children are less

capable of hard work in summer than in winter. As everything we do involves the expenditure of nerve energy, change of occupation may relieve, but it cannot remove, fatigue. After sedentary mental work a little active exercise will quicken the circulation, and wash away the fatigue products from the tired nerve cells. The stress of labor will be transferred to a different set of nerve cells. But the exercise itself increases the formation of the fatigue poison and uses up nerve energy, and consequently severe exercise or exercise requiring concentration of attention may cause more fatigue than it relieves. In the case of children at school the intervals for recreation and play do not completely remove the results of fatigue, which continues to increase throughout the day. Complete recovery takes place only during sleep, of which it is essential, therefore, that children should have enough.

D. *Sleep.*—More than two hundred years ago John Locke wrote that "nothing contributed more to the growth and health of children than sleep." How little this has been attended to! A few years ago Dr. Acland* showed that in many of the English public schools it was impossible for the boys to obtain the hours of sleep which the best authorities consider necessary, and Miss Alice Ravenhill,† as the result of an extensive inquiry, came to the conclusion that the children in the elementary schools suffered in the same way. The shortage amounts to no less than two to three hours per night. Now, this is a very serious matter. Sufficient sleep is just as essential to health as sufficient food. A man can live longer without food than without sleep, and if children get an insufficient amount of sleep they must suffer physically and mentally. Dr. Dukes says that the reason many brilliant boys are never heard of

* *On the Hours of Sleep at Public Schools*, by T. W. Acland, M.D. (Churchill), 1905.

† Trans. Second Internat. Congress of School Hygiene, 1907.

afterwards is because their "immature brain tissue was exhausted before manhood." A far larger number of children *are* heard of afterwards—in the records of hospitals for nervous diseases—for the same reason. Sleep is the food of the brain, and the brain will be a poor servant to the mind if it be not fed. The hours of sleep recommended by Dr. Dukes are shown below. They are slightly longer (half to one hour) than those given by other leading authorities.

HOURS OF SLEEP.

Age.	Hours.	Age.	Hours.
5 to 6	13½	12 to 14	10½
6 " 7	13	14 " 16	10
7 " 8	12½	16 " 18	9½
8 " 9	12	18 " 19	9
9 " 10	11½	19 " 21	8½
10 " 12	11	21 " 23	8

Young children should have as much sleep as they can be induced to take. For the first three or four years, or even longer, every child should have a sleep during the day. In schools which admit children under the age of five, provision should be made for sleep unless the children attend only in the forenoon. The children should never be allowed to sleep sitting in their seats or leaning on a desk or table. It would be far better to let them lie on the floor—*e.g.*, on a newspaper. But the only proper arrangement is to have some kind of bed on which the child can lie comfortably. A bed of stout netting or canvas, supported by wooden trestles, may be used, or the kindergarten tables may be inverted, and their legs utilized as supports for such beds extending between the tables, as well as over them.

Fresh air is just as necessary for children when asleep as when awake, and whether children are sleeping at home or at school the windows should be open. At school this may necessitate the use of some kind of covering, which, unfortunately, involves some risk of infection. Beds and

covers should therefore be numbered that each child may have his own; they should be washed at intervals, and hung outside in the sun every day on which it is possible.

Quiet and darkness are both necessary for fully restful sleep. Both at home and in boarding schools the sleep of children is often broken or curtailed by noise.

This question of sleep is quite as important to day-school teachers as to those who have the full charge of their pupils. Older children, therefore, should be instructed as to their own requirements in the matter, as to the wisdom of open windows, and the folly of late hours. The "boy scout's oath" might very fitly contain a promise to obey, as far as possible, the laws of sleep suited to his age. The objection to the views here expressed has been made that "longer hours of sleep would encourage the luxury and self-indulgence which are eating the heart out of our English boyhood and manhood." This opinion is quite contrary to that of fifty medical experts to whom Dr. Acland referred in writing the paper already mentioned.

E. *Methods of Teaching.*—The methods adopted in teaching have an important influence on mental hygiene. A teacher should know what work the children are expected to do in other classes, and the work of different classes should fit together. What is called the "correlation of subjects" is very important as a means of preventing unnecessary fatigue. Moreover, subjects of instruction should be so chosen as to correlate with the child's natural aptitudes and stage of development, and supply suitable and sufficiently varied food for mental growth.

Home lessons and examinations have received more adverse criticism than perhaps anything else in connection with education. With regard to the former, I know of no valid reason for condemning home lessons on health grounds provided the children have a full allowance of sleep and recreation, and the hours of work already laid down are

not exceeded (p. 52). The best disposition of the time must depend largely on home circumstances. The, chief advantages of *home* lessons are that children learn to work for themselves, and are subject to the discipline of being held accountable for what they do. But these advantages cannot be fully attained when children have no home facilities to work in peace and quiet, or too great facilities in the form of a tutor who does for them the work they are supposed to do themselves. Home lessons, however, should be prescribed for a definite educational purpose, and should be limited to what that purpose requires, whereas they are frequently burdensome in amount, or even set for the mere purpose of giving the child something to do.

The strain of examinations is due, not merely to the effort to achieve a large amount of work in a frequently inadequate amount of time, but also to the exhausting emotional effects of ambition, competition, or the fear of failure. All children who have before them examinations (school, college, or university) which require much preparation should be taught the following rules:

1. Work steadily. Do not imagine that present slacking can be atoned for by overwork later. Remember the Swiss guides' motto: "Ohne hast, ohne rast" (Without haste, and without rest).

2. Work hard when you are at it, but don't continue too long. Above all don't sit up working when you ought to be in bed; it doesn't pay.

3. Take some outdoor exercise every day, and a long afternoon out of doors every week. The time will not be lost.

4. Don't work on Sundays. "Six days shalt thou labour, and do *all* thy work." At a congress of neurologists in America, it was agreed that Sunday labor is largely responsible for the increase of nervous disorders in the United States, and that business men who devote their

Sundays to work, or to amusements as exhausting as work, are peculiarly liable to nervous breakdown.

F. *Rewards and Punishments.*—The natural tendencies of children towards emulation and rivalry seem to indicate that such instincts might fittingly be utilized in school. Unfortunately, however, emulation frequently stimulates a child to an unhealthy degree of excitement, and rivalry is apt to bring jealousy in its train. I am not, however, disposed to agree with those who would banish competition entirely from the class-room, but teachers who make use of it should be awake to its dangers, and carefully watch its effects upon the children. Mistresses in girls' high schools are usually uncompromising opponents of competition in any form, while masters in boys' schools often hold other views. Both may be right. Probably there is a sexual difference, and girls are more liable to be injured and less likely to benefit by competition than boys.

The question of punishment pertains to class management rather than to hygiene. Nevertheless the hygienic aspects of punishment are very important, and books on school hygiene usually and quite appropriately refer to the subject. From the point of view of hygiene punishment is an evil which should be avoided as much as possible. The saying that the better a teacher is, the less will he resort to punishment, is one that every teacher should take to heart.

Punishment may injure children in various ways.

1. *Physically.*—It ought not to be necessary to say that children should never, under any circumstances, be struck on the bead or boxed on the ears. Such assaults are distinctly dangerous, and may rupture the ear-drum or stir up to fresh activity some old ear disease whose existence is unsuspected by the teacher. Nor can any offence justify the infliction of a punishment which can fairly be called "cruel" or "brutal." Many of the objections commonly made to corporal punishment apply equally to other forms

of punishment, but there is no other which is so liable to abuse.

2. *Morally.*—An objection to corporal punishment seldom mentioned is that it is peculiarly apt to give rise to cheating. Cheating is the natural defence of the weak against the strong, and if the cane or tawse is used at all freely, unscrupulous children are sure to save themselves by cheating if they can, and the result is that children who have more conscience must either connive at cheating or tell tales; they must either cheat also or suffer punishment which they see their less scrupulous neighbours escape.

3. *Emotionally.*—An objection more frequently brought against corporal punishment is that it gives rise to depressing emotions and evil passions (fear, anger, resentment, vindictiveness). These evils are real and very great. Let anyone who doubts it consider the following facts: Eulenberg recently collected particulars of 1,117 cases of child suicide in Prussia. In 321 cases the cause was unknown, but in more than half the remaining cases the cause of suicide was connected with school, chiefly fear of punishment. Doubtless many of these children were morbid, but if even a morbid child commits suicide from school causes, the methods and discipline of that school require investigation. It is of the greatest importance that every teacher should recognize that the emotional atmosphere he creates in his class-room will affect his pupils for good or ill. Punishment, for example, may be so used as to do physical injury by interfering with happiness, appetite, and sleep, to children who have never been punished at all.

But however great the evils and dangers of punishment may be, it is idle to deny that it has its uses, or that there are occasions when it is better for a child to be punished than to escape. Corporal punishment, with all its drawbacks, may be an effective stimulus to industry. It may encourage attention, carefulness, obedience; it may nip

vicious tendencies in the bud, or keep them in check till higher motives make their appeal. But can such advantages outweigh the disadvantages? Probably the answer depends upon circumstances—the ability, temperament, and experience of the teacher; the size of the class; the age, character, and previous training of the children. Wherever punishment of any kind is made use of, everything possible must be done to minimize its evils. And much will be done if the punishments are always imposed or inflicted with strict moderation, without emotion, and with the impartiality and inevitableness of laws of Nature. Children like to have definite rules. They like to know quite definitely what they may or must do, and what they must not, and precisely what will happen if they transgress. Normal children are not apt to cherish evil feelings if punishment results from the breach of a rule which they know they can keep if they choose, and which, once made, is as binding on the teacher as themselves.

A considerable degree of strictness greatly reduces the necessity for punishment. Every good teacher who dispenses, or almost dispenses, with punishment, has very definite ideas as to the kind of conduct he expects, and intends to have. Dr. Montessori, for example, the latest exponent of the doctrine that children must have unrestricted liberty and that their spontaneity of action must not be interfered with, tells us, quite illogically, that conduct she does not approve of must be "suppressed, destroyed."

Some advocates of corporal punishment advise that its infliction should always be delayed for some hours, perhaps even till the following day. Such advice is entirely wrong. It ignores the depressing mental effect upon the child of waiting in suspense, perhaps in fear. In the case of nervous children, especially, delay greatly aggravates the punishment. Moreover, the efficiency of punishment depends mainly on its certainty and promptitude, very little on its

severity, and the chief advantage of corporal punishment over other punishments is just the very fact that it can be inflicted so promptly as to seem, especially to a young child, the natural consequence of the offence.

Another recommendation frequently made is that corporal punishment should be reserved for grave moral offences, for which it should take the form of flogging. This view is plausible. It is based upon the idea that the severity of punishment should be determined by the gravity of the offence. But this is just the old pagan view that the object of punishment is to pay the offender out—an eye for an eye, and a tooth for a tooth. There is a higher conception according to which punishment should be determined, not by the sin, but by the consideration of what is most likely to benefit the sinner. If a boy is guilty of a grave moral offence, the chief point to consider is whether the act was contrary to the boy's real character or in accordance with it. If the boy has acted against his real character, he will probably not repeat the offence, for his conscience will make him suffer; but a moderate punishment may help to restore his self-respect. On the other hand, if the act is the outward sign of a vicious nature, a severe and degrading punishment is more likely to be brutalizing than reformatory. Herbart's dictum deserves the consideration of every teacher: If a truthful child tell a self-interested lie, punish him, and then trust him; but if a deceitful child tell a lie, don't punish him, don't trust him; train him.

CHAPTER V

NERVOUS ANOMALIES AND DISORDERS

Nervousness.—We speak of people as nervous when they are more sensitive to impressions, more emotional, and more prone to exhausting expenditure of nerve energy than their neighbors. Sensitiveness is not necessarily associated, however, with a tendency to emotional display. People of the restrained nervous type are often supposed to be lacking in feeling, whereas they may really be more sensitive than others whose emotional outbreaks indicate, not depth of feeling, but lack of self-control.

Children are naturally more nervous than adults, and a nervous child differs from others chiefly in the exaggeration of natural characteristics. Nervousness, therefore, is not necessarily a morbid condition. All sensitive people, all people who are imaginative, artistic, or musical, are nervous more or less. People who are naturally nervous to a marked degree are spoken of as having a neurotic or even a "neuropathic" temperament, these terms, especially the latter, implying a predisposition to nervous affections. Many nervous affections, but not all, have a very strong tendency to run in a family. When children inherit a neurotic temperament without any actual nervous disorder, much can be done by careful management to diminish the risk of future nervous derangement. It is, therefore, of practical importance that the nervous disposition should be recognized in early life.

Nervous children are generally small and thin, though their appetite may be remarkably good. They are apt to be fussy or fanciful about their food, and are frequently subject to sick headaches. They are attractive and interesting, being intelligent, lively, and demonstrative, yet they are often selfish, passionate, and vain. They are commonly restless at night, and much given to talking or walking in their sleep.

Another type of nervous child is abnormally shy and self-contained, solitary in his habits, reticent, and given to morbid brooding. These are the children who are often misunderstood, being regarded as sullen and obstinate.

Habit Spasm is a common symptom in nervous children. The name is given to habitual involuntary movements of different kinds. Twitching the lips, blinking, raising the eyebrows, nodding the head, shrugging the shoulders, jerking the hands are common varieties. The spasm recurs every few minutes. It is important that the habit should be checked, as it is difficult to cure when it has become fixed. The general health must receive attention, and overwork and excitement must be avoided. A holiday in the country is usually very beneficial. Scolding and punishment are more likely to do harm than good.

Nerve Signs were described many years ago by Dr. Warner as useful tests for picking out the nervous children in a class. The chief signs are—

1. *General balance defective*—limp unsymmetrical attitude, and listless gait, indicating a want of nerve tone.
2. *Head balance defective*—head drooping or inclined to the side, instead of erect.
3. *Frontal muscles overacting*—a frowning expression. This may indicate headache.
4. *Corrugation*—knitting the eyebrows.

5. *Weak hand balance*—when the child is asked to hold the hands straight in front with the palms down, the wrist and the fingers droop slightly.

6. *Hand balance nervous*—in this case, when the hands are held out there is a droop at the wrist, but the fingers are slightly overextended or bent back.

7. *Finger twitching*—when the hands are held out for inspection there may be twitching movements.

8. *Jaw droop*—the mouth tends to be slightly open owing to muscular weakness.

These symptoms are specially significant when a number of them are present in one child. They are not so much a sign of the nervous temperament as of present nervousness, which requires hygienic treatment. A nervous or excitable teacher may affect a large proportion of a class with nervousness of this kind to such an extent as to be noticeable even to a casual visitor.

Overpressure has already been mentioned. It may be defined as a condition of nervous exhaustion, such as may result from excessive concentration on school studies. Its cause, however, is not so simple as the definition seems to indicate. The brain of a child may be, and should be, active during all the waking hours without injury to health, while the recuperation of nervous energy demands fresh air, and good food, and abundant sleep. Schools and school methods are often responsible for overpressure, but, on the other hand, if children are squandering their nervous energy outside school hours, or if they are stinted of Nature's restoratives, overpressure may result without blame to the school. Overwork is a bad thing, but how much work is "overwork" cannot be decided without reference to the child. Nervous children are specially liable to overpressure, because their reserve of nervous energy is so little and their expenditure so great, especially in the stimulating surroundings of a town. They may be spurred

to overexertion by the expectations of parents or their own ambition. Many suffer from demands made upon them outside school. They have to work early or late to help their family. The half-time system is a fruitful source of overpressure. There is no reason at all why a child should not spend part of the day in manual work and part in study, but in actual fact the demand made upon children by the half-time system, combined as it often is with insufficient sleep, is far too heavy for many. No less than 70,000 young people, of whom 59,000 are in Lancashire and Yorkshire, are affected by this system.

The symptoms of overpressure are those of chronic fatigue. The child has a tired look and sunken eyes, with dark rings under them. The expression is dull, and attention evidently wanders. The child has to read a thing over and over again before he knows what it is about. Often he is peevish and irritable, sleeps badly, and "does sums in his head all night long." In slighter degrees the child may be restless during the night, dull and cross in the morning, and fairly lively in the evening.

Disorders of Sleep have been mentioned. Disturbed sleep is often due to indigestion, or cold feet, or want of fresh air in the bedroom. A large proportion of nervous children occasionally talk in their sleep. *Somnambulism*, or sleep-walking, is a sign of more aggravated nervousness, and indicates that the child should for a time be withdrawn from school.

Night terrors is a name given to a condition which is quite distinct from *nightmare*. The latter is often due to indigestion. The child wakes in a fright, and says he has had a bad dream. His mind is quite clear, and he remembers the dream next day.

In night terrors the child awakes in terror of some "big dog," or other vision. He does not know those about him, and next day he does not remember what has happened.

Such attacks occur in nervous children whose general health requires attention.

Hysteria has been defined as a condition in which ideas control the body and produce morbid changes in its functions. It is not a disease of childhood, but it occurs occasionally in children. Most cases are over ten years of age. The symptoms often mimic those of other diseases. There may be very severe cough, which raises a suspicion of lung disease, but no sign of disease can be discovered. Or great pain may be complained of in some joint, and there may be limping and tenderness on pressure, so that the child is treated for joint disease, though the joint is really quite sound. Difficulty in swallowing, convulsive seizures, and many other symptoms may occur. The child's disposition is often altered. There may be fits of passion, or peculiarities of conduct, or a tendency to lie for the pleasure of deception. Such children benefit by good food and an outdoor life, removed from exciting surroundings and oversympathetic relations. The less attention is paid to the symptoms the sooner they are likely to disappear.

Care of Nervous Children.—All the nervous disorders which have been described occur especially in nervous children. The neurotic temperament is the soil out of which they spring. This temperament is hereditary, and heredity is immensely stronger than environment. What, then, can be done for a child of a markedly nervous disposition?

In the first place, it may be said that every nervous child requires individual study if he is to be understood, and his life ordered wisely. A knowledge of his immediate heredity should be of great service as an indication of the kind and degree of danger to which he is probably exposed.

But, in the second place, it must be remembered that the ancestry of every child goes back very far, back to the

very beginning of things, and however morbid the child's heredity may be, the very fact that he is human is proof that he is, in the deepest part of his nature, of one blood with normal humanity. The essential thing, therefore, in the care of the nervous child is to cultivate this deepest part, the part which in a sense is the oldest part, a part which belongs to a time when the great exciting causes of nervous disorders did not exist. Such disorders are excited in the predisposed by the rush and turmoil of city life, with its trams and motors and noisy streets, by the strain of school life, with its enforced cultivation of fine movements of hand and eye, the overburdening of memory, the excitement of class competition and of games, the anxiety engendered by examinations, the exhausting effects of private concentration on exciting books. These are the things which the nervous child cannot stand. But all these are of yesterday, and the best chance for the child with a strongly neurotic heredity would be to go back to some such life as his distant ancestors lived before these things were dreamed of. If possible he should spend his early years in the country. At any rate he should have a quiet life, with as much sleep as possible. He must be saved from all undue stimulation—stimulating environment, stimulating diet, stimulating people, parties, and theatres, and excitement of every kind. But he must live. He must not be pampered or allowed to form habits of idleness. Simple interests must be cultivated and manual occupations practised so that the fundamental functions of the brain may have time and opportunity to grow. The culture epoch theory of education is that which best meets his needs, and each stage must be lived, not hurried through, if the next is to be vigorous and sound.

Headaches are not very common in little children; in in older children they are more common in girls than in

boys. In all cases the cause should be sought for. Many headaches arise from digestive disorders, and especially from constipation. Girls above ten often complain of gymnastics as a cause of headache, and in girls a little older bloodlessness is a frequent cause. Both sexes are liable to headache as a result of too much school work. Bad ventilation and bad lighting at school or at home are more often to blame than the actual amount of work. Headache may also be due to defective vision, adenoids, and other conditions requiring special treatment. Nervous children are specially liable to headache, which may be of a severe character.

The treatment should always be directed towards the removal of the cause. Children liable to headache should never be allowed to form the habit of taking drugs or headache powders as a palliative. Such a practice may initiate the drug habit or otherwise seriously injure health.

Chorea, or St. Vitus's Dance.—Years ago a doctor, driving through a country village, saw a girl of about twelve who was suffering from involuntary jerking movements of her face and limbs. She was surrounded by a group of other children, who were making merry at her expense. Within a week or ten days fourteen of these thoughtless mockers were attacked by similar symptoms. Was this a case of infection? Not in the ordinary sense. The first child was suffering from the disease properly called "chorea"; the rest were attacked by "false chorea," due to the impression printed on their imaginations by the spectacle they had witnessed. This false chorea is similar to the dancing mania of the Middle Ages. The case is worth mentioning, because it illustrates what a powerful effect strong nervous impressions may have on children. True chorea is the disease which is popularly, but not quite properly, designated "St. Vitus's dance," a name originally given to the dancing mania just referred to.

True chorea is a nervous disease which chiefly affects children between seven and fourteen. It is twice as common in girls as in boys. Fright and overpressure at school may be factors in its production, but the essential cause in most cases is the action of the poison of rheumatism on the nerve cells of the brain.

The symptoms come on gradually. The child seems unusually nervous, and has difficulty in writing and drawing. He may be blamed for dropping things or making faces. Then irregular spasmodic movements are noticed which may extend to all parts of the body. These are not under the control of the will, and may become so severe that the patient can do nothing for himself. The disease lasts for six to ten weeks, and is very liable to recur.

Cases vary greatly in severity, and slight cases may be mistaken for "habit spasm." However slight the symptoms, no child suffering from true chorea should be at school. Rest in bed is nearly always necessary, as well as careful medical supervision. Chorea is a fruitful cause of heart disease, or rather rheumatism affecting a nervous child is the cause of both. It is important to remember this when a child who has had chorea comes back to school. Such children must not be subjected to mental or physical strain. Being nervous, they must not be pushed in their studies; being rheumatic, they must be carefully protected from cold and damp, and they must be restrained from physical exertion which might tax their heart unduly.

Epilepsy is a disease which usually begins during school life. In a large proportion of cases there is a history of epilepsy or insanity in the family. It occurs in two forms—minor and major.

In *minor* epilepsy, the chief symptom is a loss of consciousness of short duration, often regarded as a fainting fit or an attack of dizziness. Sometimes the child does strange things during the attack without knowing what he

is doing. Thus, he may tear a book, or take off his jacket. The periodical recurrence of the attack indicates its nature.

The *major* form is characterized by the occurrence of epileptic fits. The symptoms of these are well known. "Lo, a spirit taketh him, and he suddenly crieth out; and it teareth him that he foameth again, and bruising him hardly departeth from him." The child gives a sudden cry, and falls violently as if thrown down. There is foaming at the mouth. Severe convulsions, during which the tongue may be bitten, last for several minutes. The face is first pale, then livid. The child may wake up dazed when the convulsions cease, but usually he passes into a deep sleep, which may last for several hours.

The mind is nearly always affected in cases of epilepsy. A few famous men have suffered from epilepsy, but a large proportion of epileptics are mentally defective; many are imbeciles. When major epilepsy begins in childhood, there is not only retardation of mental development, but progressive deterioration. Between the fits the child may make considerable progress, most of which is wiped out when the fits recur. Some cases of epilepsy recover under treatment, but in many of the severe cases, and especially where there is a hereditary tendency to nervous diseases, there is no prospect of cure.

Epileptic children sometimes attend ordinary schools, for it often happens that the fits occur only at night, or they may be infrequent, and the mother may be able to tell when a fit is impending, and keep the child at home till it is over. Severe cases, with frequent fits, are best in a residential colony, where they can be classified according to their mental and physical condition, and receive the medical supervision they require. The majority of such cases should be kept in a colony for life, for they will never be able to earn their own living. Under supervision, however, they may live happy and useful lives, and contribute

by their work to their own support. Provision of the kind required is at present very inadequate.

The general requirements of epileptic children are the same as of nervous children generally—fresh air, non-stimulating food, and avoidance of mental overstrain. The diet should even be vegetarian, as meat is too stimulating, and the digestion should be very carefully attended to. Drugs are very useful in treatment, but must not be used as a substitute for the hygienic measures mentioned.

MENTALLY DEFECTIVE CHILDREN

Every teacher should have some practical acquaintance with the common varieties of mental defect, and should be able to form an opinion as to a child's capacity for education. Intellectually considered, children may be divided into the following groups:

1. Children above the average in intelligence.
2. Children of average intelligence.
3. Backward children. Some of these are backward in their studies because they came late to school. Others have been retarded in their mental development by illness, malnutrition, or some defect of sight or hearing. The former are quite evidently intelligent, the latter may seem dull; but if the cause of the retardation is remedied, or if they are placed in a special class where individual attention can be given by the teacher, they often make good progress, and their intelligence is found to be normal.
4. Mentally defective children, classed as idiots, imbeciles, and feeble-minded, according to the degree of defect.

The care of the mentally defective is one of the most important social problems of the present day. This is due to the greatness of their numbers, their unfitness for self-direction, the ease with which they blunder into crime or are led astray by bad companions, the existence in many

of them of strong vicious propensities, and the belief for which there is much support, that they are increasing in numbers out of proportion to the normal population. Dickens has drawn admirable pictures of a number of typical cases of this kind—Barnaby Rudge, Jo the crossing-sweeper, Mr. Dick and Mr. Toots, Maggie in "Little Dorrit," Smike at Mr. Squeer's Academy, and Dora in "David Copperfield." Such people may live happy lives enough if they are well cared for, but left to themselves what can become of them? At the present time thousands of them spend their lives in and out of prison, and thousands more in and out of the workhouse; and in either case they are often worse off outside than in.

Mental Deficiency must be carefully distinguished from simple backwardness. Mental deficiency is due to an original defect in the brain (rarely to some injury or disease affecting the brain in early life). By far the most important cause is a neuropathic heredity. A study of the family histories of 1,000 cases of feeble-mindedness in Manchester showed a family history of insanity, epilepsy, or mental deficiency in 48·4 per cent., and this figure is below the truth, as the relations, in many cases, were unable or unwilling to give exact information. Tredgold found a family history of epilepsy or insanity in 64 per cent. of cases.

General Characteristics.—Idiots of the lowest grade are absolutely helpless and incapable. These cases never come to school, and need not be further considered. Imbeciles are of various grades, but all are capable of some training. Thus, they can dress and undress themselves, feed themselves, and keep themselves fairly tidy. They may be able to speak fairly well, though their speech betrays a poverty of ideas. They may even learn to read and write a little, but they are never good at composition. Some are extremely restless and mischievous, and unabashed by the presence of strangers. Others are morbidly shy. In some cases the

moral nature is even more defective than the intellectual, and they may be given to lying, thieving, and deceit to such an extent that their presence in school cannot be tolerated.

In considering the question whether a child is capable of education, there are three qualities to which a teacher would pay special attention. These are memory, attention, and interest. In mentally deficient children these qualities are always defective. The relations, indeed, often claim that the child has a good memory, and attends to everything. But although a child may remember some things very well, his memory may not be serviceable for school purposes, and the fact that he attends to everything may simply mean that everything distracts his attention, while capability for sustained attention is lacking. The teacher must therefore base his judgment on his own observations, and not on what he is told by others.

The instinctive tendencies of the child must also be studied. In mentally defective children many of the normal instinctive tendencies and activities are absent, or weak, or delayed in their time of appearance. But education necessarily depends upon such tendencies and their associated interests and activities. A careful consideration of the child's native instincts, therefore, must throw light on the problem of the extent to which he is capable of benefiting by education.

The Care of Mentally Defective Children.—Some provision, but to a very inadequate extent, was made for mentally defective children by the Defective and Epileptic Children Acts of 1899 and 1903. Far more extensive provision has been made by the Mental Deficiency Act which came into operation in 1914. This Act recognizes the following classes of defectives:

1. *Idiots*—the lowest grade—are "unable from birth or from an early age to guard themselves against common physical dangers."

2. *Imbeciles* are "incapable of managing themselves or their affairs, or, in the case of children, of being taught to do so."

3. *Feeble-minded* persons "require care, supervision, and control," or, in the case of children, "appear to be permanently incapable of receiving proper benefit from the instruction in ordinary schools."

4. *Moral imbeciles* combine mental deficiency "with strong vicious or criminal propensities, on which punishment has had little or no deterrent effect."

These definitions are not very good. As feeble-minded persons, not being imbeciles, are capable of managing their own affairs, it is not quiet clear why they require care, supervision, and control, and there is room for any amount of difference of opinion as to what is meant by "proper benefit" from school instruction. In connection with similar legislation in France, M. Binet has proposed more definite distinctions—viz., that the term "idiot" shall be applied to cases too defective mentally to learn to speak; "imbecile" to those too defective mentally to learn to read and write; and that any child under nine who is two years, and any child of nine or more who is three years behind other children of the same age in school-work shall be "suspected of feeble-mindedness" unless his backwardness can be accounted for in some other way, such as insufficient or irregular attendance at school, defective sight or hearing, or ill-health. Such a child should be sent to a special school or class, where his progress under instruction will soon show whether he is really defective or simply backward.

With regard to moral imbeciles, the term "imbecile" seems to imply that the degree of mental deficiency in moral defectives must be high, but that is by no means the case. There are certainly children who have very little mental deficiency who yet have strong innate vicious pro-

pensities on which punishment has little effect. In such cases kind but firm treatment may in time overcome propensities which harshness and severity would only aggravate.

It must be clearly understood that true mental deficiency is not a curable condition. No education or training can turn a mentally defective child into a normal one. It is true that the claim is often made that special schools cure a certain proportion of their cases. The explanation of this is that these schools admit a certain proportion of spurious defectives who for some reason had fallen behind in the ordinary school, but who were able to make up lost ground under the individual instruction of the special schools. True defectives should be under guardianship or in a residential colony for life.

The Royal Commission on the Feeble-Minded estimated the number of "mentally defective" persons, exclusive of lunatics, to be about 150,000 in England and Wales. The existing provision for the care of feeble-minded children is almost entirely in the form of special day-schools, which accommodate approximately 12,000 pupils. The new Act provides that the local Education Authority shall notify to a committee for the care of the mentally defective "those children who, on or before attaining the age of sixteen, are about to be discharged from the special school, and in whose case the local education authorities are of opinion that it would be to their benefit that they should be sent to an institution or placed under guardianship."

At these special schools the children are usually kept for the day. The curriculum is adapted to the capacity of the children. In some cases reading and writing can be taught; in others time so spent would be simply wasted. In all cases much attention is paid to physical health and to the development of speech. Much of the time is devoted to manual work. In the case of the older girls this takes

the form of housework of all kinds, while gardening and agriculture have been found specially suitable for the boys. Apart from lifelong supervision, however, the training given in these schools is likely in the majority of cases to be thrown away, or even turned to bad account, when the child becomes an adult. On the other hand, the segregation of the feeble-minded in residential colonies where they can contribute by their labor to their own support is no hardship to them, but quite the reverse. "Children who never grow up," they have in most cases no other ambitions or desires.

Frequency of Nervous Disorders in School-Children.—Some idea of the frequency with which nervous disorders occur among school-children may be obtained by studying the following table, which was prepared by Dr. John Priestley. It is based upon the examination of 62,236 Staffordshire children in three age groups—five to six, eight to nine, and twelve to fourteen.

Disorder.	Number of Cases.	Cases per 10,000 examined.	
		Boys.	Girls.
Mental:			
Dull and backward	2,818	901	623
Mentally defective	148	49	31
Stammering	271	67	20
Lisping	275	45	43
Idioglossia	259	53	29
Nervous System:			
Spasmodic affections	87	17	11
Paralysis	145	29	18
Epilepsy	61	13	6
Chorea	24	2	5
Headache	1,471	181	293
Functional disorders	817	124	138

It will be noticed that in nearly all cases boys are affected in much larger proportions than girls.

CHAPTER VI

THE HYGIENE OF EXERCISE

Bones, Joints, and Muscles.—Every teacher who has anything to do with physical training should understand the general arrangement of the bones; the disposition of the joints and the range of movement possible for each; and the grouping of the muscles which effect these movements. It is not necessary to know very much, but there are many exercises in the official syllabus which it is quite impossible to teach intelligently without some special knowledge.* A teacher who attempts it is like one who proposes to teach a proposition of Euclid which he has learned by heart, but does not understand. No doubt mechanical teaching may be effective, but it is rather dull, to say the least.

Consider such an exercise as "deep breathing with arm stretching upward." This should not be thought of as two exercises carried out simultaneously, but as a single breathing exercise. The upward stretch is part of the inspiratory movement. And why? Because when the arms are stretched upward to the fullest extent, the movement is not confined to the shoulder-joints, but the shoulders themselves are lifted up almost to the ears by the strong muscles of the neck. Now, the shoulders are attached by the breast muscles to the front of the chest, and therefore when the shoulders are thus lifted up they draw the front of the chest with them, and thus cause the chest to expand. The movement is precisely what is

* See author's *Elementary Physiology*, chaps. vi. to ix.

carried out passively in Sylvester's method of artificial respiration used in drowning accidents. All this can easily be made out upon one's own person, or upon a child, and a teacher who understands it will understand also how ineffective the exercise must be if the arms are simply raised at the shoulder—a very common fault, though it is not mentioned in the syllabus.

Now, let us consider the "across bend position" (arm bending across). This also is a breathing exercise. One of the common faults is to bring the elbows too far forward. But when the elbows are drawn well back, what happens? It is quite easy to make out upon a child that drawing the elbows back means drawing the shoulder-blades back and nearer to the spine. Now, there is a strong flat muscle (the serratus magnus) which passes from the shoulder-blade round the side of the chest to be attached to the lower ribs. If you stand behind a small boy, and pass your hands under his arms until you can take hold of the front of his jacket, your arms will be very much in the position of this muscle. If you pull, you will tend to open the front of the boy's jacket. Just in the same way, when the elbows (*i.e.*, the shoulders) are drawn well back, the serratus muscle draws upon the ribs and expands the chest.

The same remarks apply to other exercises, such as "neck rest" and "arm parting."

One other example may be taken—a very important "corrective" exercise—"head bending backward." Every one who has an elementary acquaintance with the skeleton knows that the skull is balanced on the top of the spine by means of two curved knobs of bone like the rockers of an armchair. The skull rocks on these so easily that if we want to look at the ceiling we can throw back our head with practically no exertion at all. In doing this, the chain is carried forward; no effect is produced on the spine. But suppose we try to throw back the head and keep the chin

in at the same time, what will happen? Keeping the chin in means fixing the skull so that it cannot rock upon the spine. If we do this, and then try to bend the head back, the movement must take place in the spine. This will tend to straighten the forward bend of the spine, exaggerated, perhaps, by stooping over the school-desk. This is the object of the exercise, which is by no means an easy one to carry out properly. Indeed, it is impossible to *complete* the exercise without carrying the chin forward to some extent, as the little girl in the illustration in the syllabus is evidently doing. But the point is that the great muscles of the back must act powerfully on the spine, and do their best to "bend it straight."

FIG. 7. Head exercise. (From the Syllabus of Physical Exercises for Schools, 1909.)

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Let the reader consider for himself to what extent these remarks apply to such exercises as "trunk bending forward and backward."

Physical Exercises.—Children left to themselves take a great deal of physical exercise in the form of play. Such exercise is of great value in different ways, for it is—

1. *Nutritive.*—Exercise quickens the heart's action, and consequently the circulation of the blood. Exercise also quickens the breathing and makes it deeper, with the result that more oxygen is absorbed by the blood from the lungs. The flow of lymph is also increased. Thus, all the organs of the body receive a richer, freer flow of blood and an increased amount of nutriment. But exercise also

involves the expenditure of energy and a degree of tissue waste. This, therefore, increases the demand for energy-producing and tissue-building food. Hence appetite is increased, and more food is taken and assimilated.

Exercise has a local as well as a general nutritive effect, for the blood flows most freely to the parts which are most freely exercised. A blacksmith by his work improves his whole muscular development, but especially that of his arms.

2. *Recreative.*—It is a familiar experience that prolonged brain-work produces a feeling of fatigue and inability to attend. A little physical exercise, however, quickens the circulation, increases the amount of oxygen in the blood, and washes away the fatigue products from the cells of the brain. Short intervals for play improve the child's work in school; recreative exercise on Saturdays improves the teacher's.

3. *Educative.*—Nature prompts children to play, with the object, so to speak, of training their motor ability. Children spontaneously practise balancing exercises of increasing difficulty in standing, walking, running, hopping, skipping, etc. A little child playing with a ball practises the coördination of the fundamental movements of the trunk and limbs. An older child playing marbles practises a finer coördination of the accessory movements of hand and eye—just those necessary for manual work such as writing or sewing.

The purely nutritive effect of exercises could be obtained by running aimlessly to and fro. Quickness, accuracy, and grace of movement are added by play.

Physical Exercises in School.—Physical training in schools should aim at the same nutritive, recreative, and educative results as are naturally promoted by play.

The exercises chosen should follow the natural order of development. We should not try to teach children the finer and more difficult accessory movements until they

have some skill in the less difficult, and the less difficult accessory movements should be built upon the fundamental.

Moreover, in schools yet another aim has to be kept in view—namely, the improvement of physical defects, such as weak circulation or a poorly developed chest; the counteracting of deformities due to irregular growth or faulty postures; even the cure of actual disease. The fact of a child being weakly, therefore, is not a reason for excusing him from physical exercises altogether, but rather for placing him in a class with other delicate children under a properly qualified instructor, who can give them the special attention they require.

The teacher must keep in mind also that the training of the muscles is in reality a training of the nervous system. All definite bodily movements involve a coördinated contraction of a number of muscles. The learning of a new exercise involves mental exertion and concentration of attention, just as other school lessons do. When such lessons are carried out a number of times, however, the movements gradually require less and less attention, until they become almost automatic. In this way the educative value of the exercise diminishes, but its nutritive value remains. Children must, however, first of all learn the simpler movements, and as these become automatic in their performance, more and more complex movements, requiring finer coördination, may be added.

Another point of importance is that exercises should be made as pleasurable as possible. It is for this reason that games are such a valuable means of physical training. Games afford exercise to a great variety of muscles. The pleasure which they afford results in their being continued for a time which would be irksome in the case of formal exercises. Moreover, the principal games train the mind as well as the body. They require attention, observation,

skill, resourcefulness, judgment, and the power of rapid decision. The fact that they are played in the open air is obviously another advantage.

The Child in School.—Age has an important influence on the needs of the body and the form of exercise which would be useful.

1. *Young Children.*—Physical exercise is required to compensate for the want of movement which school-work generally involves. For nutritive purposes almost any simple movements which can be carried out with little expenditure of nervous energy are beneficial. To get the benefit of such exercises, they should be carried out several times a day for a few minutes at a time. Musical drill is also of value, but the children should first learn the movements without music. Some of the kindergarten games are valuable as combining both bodily exercise and mental training.

2. *Older Children.*—As children grow older, the educative aspect of physical exercises becomes more and more important. Especially during the period of rapid growth which occurs after twelve years of age, the incomplete control of muscle balance and the want of coördination in movement are evident in awkward attitudes. Many children are particularly susceptible at this time to overstrain if severe exercises (*e.g.*, rope-climbing) are given or permitted. The exercises should aim at the development of muscular control and graceful and elegant movement. The movements required involve not merely the larger fundamental, but the finer accessory movements. In learning such movements, careful attention is required, and therefore, it must be remembered, fatigue is liable to result.

The Swedish system of physical training (which forms the basis of the Board of Education syllabus) consists of exercises which have been carefully thought out for the purpose

of promoting muscular coördination. The exercises are carefully graduated from the simplest to the most complicated, and they ought to be done with care and precision at the word of command, and with due regard to full and deep breathing. This form of drill is most valuable for the older pupils, to whom the reasons for the various movements can be explained. Unless this is done, the drill is liable to become irksome, whereas if the pupils become interested, they may practise it for themselves.

A feature of the system is that the exercises are arranged in ten classes, each complete lesson consisting of selected exercises from each class in order. For school purposes two of these classes (shown in brackets below) are often omitted, as in the official syllabus. The classes are—

1. Introductory and breathing exercises, class formations, etc.
2. Arch flexions, or bending backward and forward.
3. Arm balancing and stretching. [Hanging and climbing.]
4. Balance exercises, to improve the posture.
5. Shoulder-blade and arm movements to raise and widen the chest.

[Abdominal exercises.]

6. Trunk turning and bending sideways.
7. Marching, running, and jumping.

[Leaping or vaulting over Swedish horse.]

8. Breathing exercises.

This system is now in vogue in nearly all European countries and in America. It has been criticized as being of a too military character. It had, indeed, a military origin, but it is not really open to the same objections as ordinary military drill, which aims at producing strength and endurance, and is liable to put too great a tax on a child's energy. It is, indeed, extremely adaptable, even to the needs of delicate children. The teacher must, of course,

choose the exercises with careful reference to physical capacity, remembering that the way in which the exercises affect the children is more important than the way in which the children do the exercises. The various faults mentioned in the syllabus should be carefully studied. The frequent repetition of a fault, either by individuals or by the class may be an indication that an exercise is too severe, a hint to drop it for a time rather than persevere or allow the exercise to be done badly. The "neck-rest" position, for example, which the syllabus includes in the exercises for children of seven, involves what is to many too great a strain, the endeavor to avoid which results in round shoulders and drooping head.

With regard to the frequency with which physical exercises should be taken in school, it is not possible to lay down rules, because so much depends upon circumstances. Children ought to have active exercise in the form of outdoor games every day. This is not always possible, especially in the case of the town child. But the more the child is restricted in respect to free play, the greater the necessity for drill at school, preferably in the open air. Whenever two sedentary lessons succeed one another without an interval for play, two minutes or three minutes may be devoted advantageously to recreative or corrective exercises in the class room. In town schools especially drill may advantageously be supplemented by organized games and dancing. Some of the old folk dances have recently been revived, and are a most useful adjunct to physical training.

The question of abstention from drill or gymnastics is of much practical importance. Here the doctor should work in coöperation with the teacher. Girls of ten or eleven years and upwards are especially apt to want to be excused from drill. Sometimes they complain that the exercises cause headache or giddiness. Weakly, ill-nourished chil-

dren, or children who have recently had a severe illness, may be injured by the exercises intended to benefit their health. Some children may bring a certificate from the family doctor stating that they are unfit for drill or gymnastics. Yet in such cases, although the children may be unfit for the ordinary class exercises, they may benefit greatly by exercises of a suitable kind if these can be prescribed by a doctor whose directions are carried out by an expert teacher.

In the case of boys, if not of girls, physical training should include competitive athletics. All boys who are not physically unfit should be included, precautions being taken to guard against overstrain (*vide* p. 109). In New York a system of inter-class competitions is in vogue for the purpose of including the non-athletic boys. Two classes which are judged equal in average age and physique compete, and the one which makes the best average in each event wins. Such a scheme could only be carried out in a large school—one school in New York has 5,000 children—or by the coöperation of neighboring schools. Another plan, which may be carried out in any school, is to arrange standards for running, jumping, etc., to which all the boys must try to attain. The boys should be classified by physique, and not by age. In British public schools boys are classified by height for jumping. According to Dr. R. Tait MacKenzie, in New York boys are classified by weight instead of by age for both running and jumping. "The scales are set at the weight limit, and the boy who raises the bar is ineligible. This is quick and conclusive, and prevents all possibility of discussion."

It is not possible to formulate any standards of physical ability to which it can be said a child of a certain age, or weight, or height, ought to attain. A good country boarding school would require a very different standard from an elementary school in a crowded town area. But

it would not be difficult for any teacher to devise a scheme of marks for physical attainment which would suit the circumstances of his own school, and which would encourage the less active children to practise running, jumping, and other exercises.

THE HYGIENE OF POSTURE

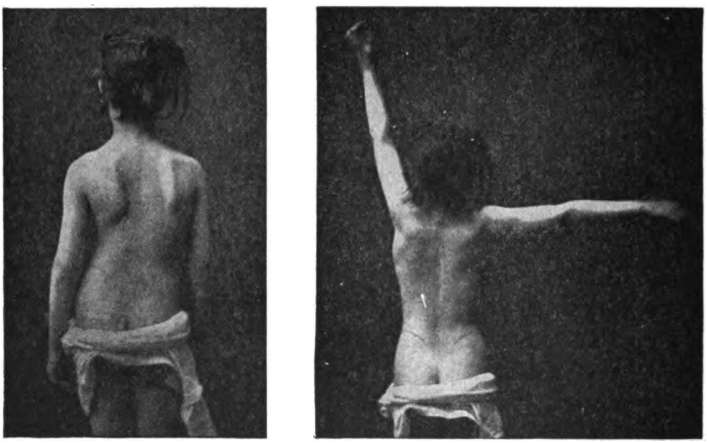
The saying that "as the twig is bent the tree is inclined" is very applicable to the frame of the child. The force of racial heredity guides the child's developing body towards the normal healthy human form, but the comparative softness of youthful bones permits of their growth being guided into pathologically unsymmetrical shapes. The twig becomes inclined which ought to be straight. Even a healthy normal child will grow round-shouldered or flat-chested if subjected to untimely toil, or made or permitted to sit for long hours doubled up over books. Much more does the child suffer whose bones are abnormally softened by rickets, whose muscles are flabby from poor food or close confinement, or who has been subjected to the stresses and strains of disease.

Posture and Deformities.—There are several common deformities for which school life is held in large measure responsible.

Scoliosis, or lateral curvature of the spine, is the most important deformity of this class. It may occur at any age, but is most frequent in rapidly growing children in their teens. The worst degrees are much more frequent in girls, but slight degrees are quite common in boys.

The nature of the deformity is that when the child stands as straight as she can, the spine assumes a curve—either a long single curve or a double curve like an *S*. When the curve is marked, the ribs, which are attached to the spine, are affected to such an extent as to produce

deformity of the chest. The amount of deformity varies from a very slight curve, such as would occur temporarily if a child walked with one boot on and one off, to a very serious malformation indeed. It used to be supposed that this deformity was due to weakness of the bones and joints, and children affected were made to lie on their back on a board for several hours daily. It is now known that the chief predisposing cause is muscular weakness. The ex-



A. *B.*

FIG. 8. Lateral curvature of the spine. *A*, Ordinary standing posture; *B*, the amount of improvement which will be effected by suitable exercises. (After Dr. Roth.)

citing cause is bad posture in sitting or standing. The erect posture, whether in sitting or standing, is maintained by muscular contraction. If the muscles are weak, they soon tire, and the child seeks relief in some faulty posture which twists the spine. In school faulty postures may actually be imposed by the desk, or even by the teacher. Thus, if a child is taught, when writing, to sit with the left side to the desk and the left arm raised upon it, a curve is

produced in the spine which may be considerable if the desk is a little too high or too far away. In this case the left shoulder is raised, and if the child's body gets an abnormal set, the mother's attention may be attracted by what she calls "the shoulder growing out."

Lateral curvature may also arise from other causes, such as a contraction of one side of the chest or an inequality of the legs. If one leg is shorter than the other, lateral curvature will arise unless the short leg is raised upon a thick sole.

Round shoulders and *flat chest* and *drooping head* are faults which are often found together, and may end in permanent deformity. They are often associated with some favorite position. Thus, the short-sighted child who takes every opportunity to retire with a book to the sofa, in the corner of which he sits with his knees drawn up towards his nose, is adopting a certain means of developing the three deformities referred to. A similar posture, though less aggravated, is assumed in bending over a desk which is too low, or in leaning forward on a music-stool when practising at the piano.

Another way in which the same bad posture of the spine is brought about is the common habit of slipping forward on a broad seat, and at the same time leaning back so that the spine is supported above and below, and bent backward like a bow between.

Flatfoot is a deformity which is similar to the above, in that it is associated with muscular weakness. It is due to the giving way of the arch of the foot which normally is supported partly by the tension of certain muscles, partly by strong bands or ligaments. It is generally caused by too much standing in people who are not muscularly strong. It is not specially liable to be produced in school but it may be that the "foot open" position in drill has a tendency to cause flatfoot if carried too far—say beyond

60°. There is therefore an objection to the right angle position of the feet sometimes adopted.

Deformities not due to Posture.—Rickety children are very liable to postural deformities such as those mentioned owing to their muscular weakness, but they are also liable to deformities due to *pressure* from the weight of the body. These take the form of curvatures of the bones. Knock-knee and bow legs are also frequent, though not confined to rickety children.

Deformities due to Tubercular Disease. — Tubercular disease is a very common cause of deformity. It is said

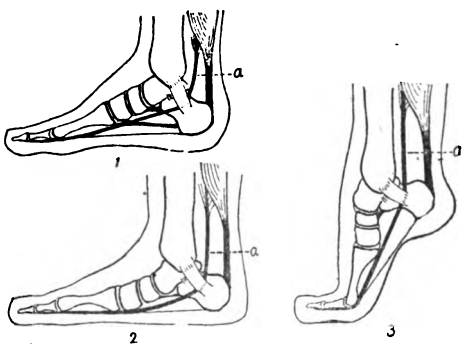


FIG. 9. Flatfoot. 1. Normal foot, showing arch. 2. Flatfoot, showing flattening of arch. 3. Tip-toe exercise, showing restoration of arch. *a*, Tendon of flexor muscle of toes, which assists in maintaining and restoring arch.

that there are 200,000 cripples in Great Britain whose deformity is due to this cause. Children with tuberculosis of bones or joints are not very frequently met with in school, but the early symptoms may be first noticed by a teacher. It is important that these cases should be recognized early, because a great deal can be done to arrest the disease and prevent deformity. Amongst early symptoms which may attract the teacher's attention may be mentioned swelling (*e.g.*, of the wrist), limping, perhaps with pain in the hip

or knee; unwillingness to run about, owing to tenderness in some joint; or stiffness of the spine. An early sign of tubercular disease of the spine, which gives rise to angular curvature (hump-back), is awkwardness in bending the back, or unwillingness to stoop or to jump off a chair.

Prevention and Treatment of Postural Deformity.—To prevent the occurrence of deformities, children require abundant exercise in order that their muscles may be strong enough to maintain a good posture without undue fatigue. But this is not sufficient unless care is taken to see that good posture is actually maintained.

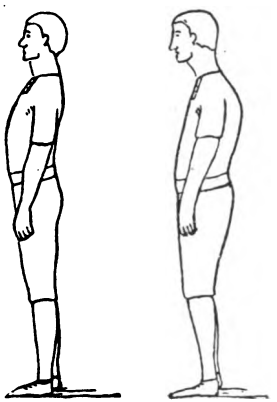


FIG. 10. Good and bad standing posture.

Correct Posture for Standing.—When called upon to read in class, a child very often stands, and is allowed to stand, with head drooping, feet apart, and body inclined to one side. This position is a step in the direction of round shoulders, flat chest, and curved spine. Instead of this, the child should stand erect, with his head directed forward, his shoulders thrown back, his book raised sufficiently high to be read easily. His feet should be placed one a little in front of the other. In this way a child can find relief by throwing the body a little forward or a little back, or by changing the position of the feet, without affecting the symmetry of the body. On the other hand, if the child separates his feet sideways, he will lean to one or other side, thereby causing a bend in the spine.

Correct Posture for Sitting.—In sitting, the body should be symmetrical, the spine erect, and the head should not be drooping. The feet should rest easily on the floor.

Any marked habitual deviation from this position is a step towards some postural deformity, and it is owing to the prevalence of such deviations during school life that corrective exercises are so necessary a part of physical training.

The tables of exercises in the Board of Education syllabus include the corrective exercises required for regular use, but mention may be made of a few exercises specially suit-

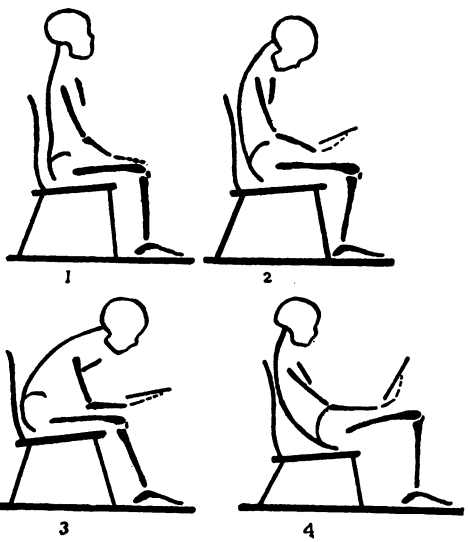


FIG. 11. Sitting postures. 1. Good. 2, 3, 4. Bad, causing drooping head, flat chest, and round shoulders.

able for particular tendencies to deformity. Marked deformities should be treated by someone with a special knowledge of medical gymnastics.

Flat Chest.—Correct standing posture; deep breathing, with arm stretching upwards.

Round Shoulders.—Correct standing posture; also head bending backwards; trunk bending backward; deep breathing, with arm stretching forward (head back!).

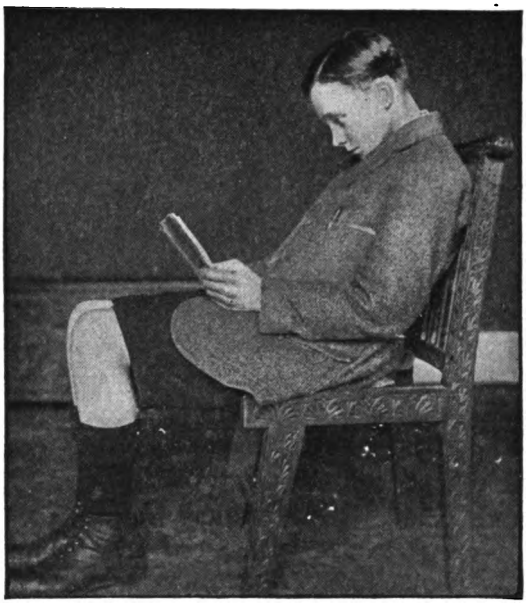


FIG. 12. How to get drooped head, flat chest, and round shoulders.

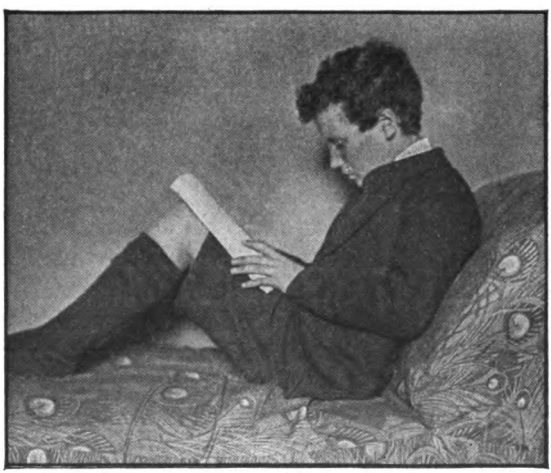


FIG. 13. Bad posture at home. (*Same effects as Fig.* 12.)

Flatfoot.—Heel raising with toes in, heels out; repeat twenty to thirty times; walking without bringing heel to ground; walking on outer border of foot.

Scoliosis.—See that tight clothing does not interfere with proper posture—a common fault. Remember that in such cases fatigue occurs quickly in any posture. Exercises as for round shoulders; shoulder-blade exercises. One-sided exercises must be adapted to each case.

SCHOOL FURNITURE

The seats and desks in a class room are often all the same size. The children never are. Few people, even teachers, realize how great are the differences commonly met with in children in the same class. Actual measurements have shown a difference of $7\frac{1}{2}$ inches in height at five years, 10 inches at ten years, 16 inches at fifteen years. Such extremes are not met with in every class, but they occur, and differences only a little less are very common. The result is that, wherever the seats and desks are of uniform size, some children are forced to spend a number of hours daily at desks which necessitate injurious postures. This is well seen in Fig. 14. Nearly all the children have spontaneously adopted bad postures in order to adapt themselves to the furniture.

Seats and Desks should be Adjustable.—In an ideal class room the furniture would be made to fit the children, instead of the children being made to fit the furniture.

Seats.—The height of the seat should be such that the child can sit with feet flat on the floor, legs vertical, thighs horizontal. The seat should be broad enough to support the whole length of the thigh when the pupil sits back in his place. Seats are more comfortable if they are slightly hollow or slope slightly back. The seat should have a back, which should give support over the lower part of the

FIG. 14. Class room ventilated by Chaddock windows. Note also bad postures in writing.

shoulder-blades and also in the small of the back—*e.g.*, by an adjustable pad, or by being shaped to fit the natural curves of the spine.

Desks.—The *height* of the desk should be such that its edge is on a level with the pupil's elbow when he is sitting

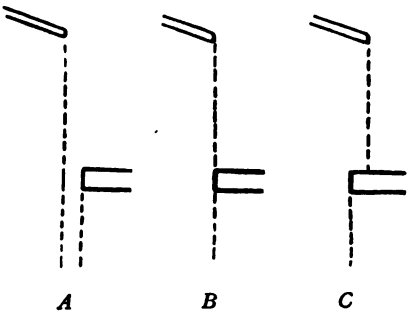


FIG. 15. Edge of desk and edge of seat, to show *plus*, *zero*, and *minus* distance.

erect with the arm bent and the elbow a hand-breadth from the body. The *slope* of the desk should be 15° for writing. A greater slope would throw less strain upon the eyes, and would therefore be preferable; but with a greater slope it

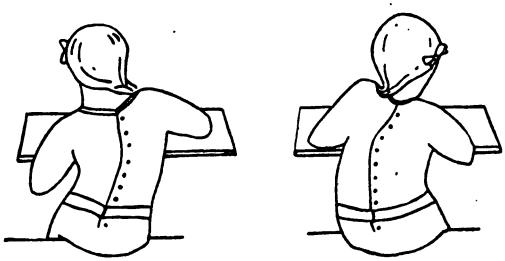


FIG. 16. How to get spinal curvature.

is not easy to write with ink, and books are apt to slip off the desk. For reading it should be possible to support a book at an angle of 45° without bringing it too near the eyes. The *distance* of the desk is important. Distance is

defined as *plus*, *zero*, or *minus*, according to whether the edge of the desk is vertically over the floor, the edge of the seat, or the seat. The desk should be adjustable for minus distance, as a minus distance of 2 or 3 inches conduces to good posture in writing, but a fixed minus distance leaves the child with too cramped a space. Consequently a desk arranged for minus distance should be capable of sliding back into the plus position, or of being lowered out of the way.

Foot-rests are not desirable, because they add to the com-

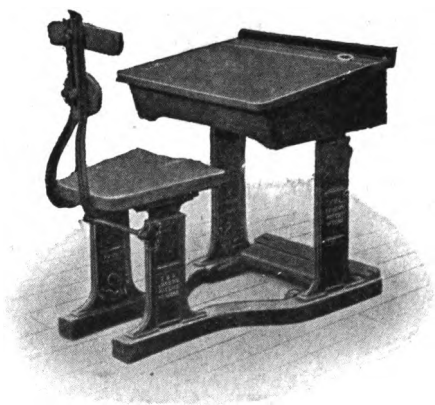


FIG. 17. Adjustable desk — "The Farringdon." (Made by The Educational Supply Association.)

plication of the desk and interfere with the sweeping of the class-room. Usually they allow dust to collect underneath.

Adjustable seats and desks are unfortunately expensive, but it is almost impossible to maintain good postures without them, and even where it is necessary to economize in school furniture, adjustable seats and desks might at any rate be supplied in the upper classes where the differences in height are greatest.

Dual Desks are very largely used, their cost being scarcely half that of single adjustable desks. In addition to being non-adjustable, they have the fault of bringing

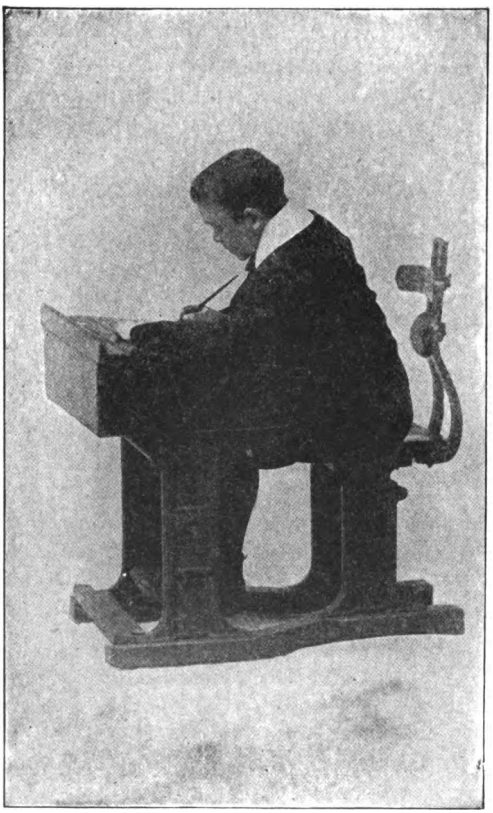


FIG. 18A. Faulty posture due to mal-adjusted desk.

neighbouring children into too close association, and thereby increasing the risk of infection. As a general rule, also, the width of sitting room allowed for each child is insufficient, the width allowed having been based on

measurements of the child's hips instead of shoulder measurements. Where dual desks are used, there should be at least two sizes in the class-room, but these should not

FIG. 18B. Good posture spontaneously assumed at properly adjusted desk.

be arranged, as sometimes recommended, with the larger size behind and the smaller in front. It is preferable to arrange the larger seats on one side of the room, so that a tall child who is deaf or shortsighted may be allowed a front seat.

Long Desks and Single Seats.—This system has the advantage that each child has his own seat, and the small number of supports for desks and seats facilitates the cleaning of the floor.

When seats or desks contain movable parts, the hinges should be so constructed and cased as to eliminate the risk of injury to fingers.

Furniture for Infants.—In infant class-rooms there should be no fixed desks or seats, but small chairs of suitable size, and low tables sufficiently broad and substantial not to be easily overturned, but light enough to be easily carried aside by two children when the floor area is wanted for games.

Summary.—Desks and seats should be single, and adjustable to height and distance. The pupils' backs should be properly supported. Generally speaking, the desks and seats should be fixed to the floor, as their supports may then be simpler in construction, thus avoiding connecting bars which are in the way, increase noise in class, and form dust-traps. If non-adjustable single or dual desks are used, each class should contain different sizes, the probable sizes required being determined by actual measurements of children in a neighbouring school, grouped according to classes, and not according to ages.

Finally, it may be repeated that, although unsuitable desks and seats compel children to assume faulty postures, perfect desks and seats will not compel them to assume good ones. They will, however, make it easy to adopt a good posture, and minimize the fatigue of maintaining it.

WRITING

The old method of teaching writing consists in causing children of five or six to write interminable strokes and pot-hooks between the lines of a copy-book. The copy-

book is placed a little to the right. The penholder must be held in a special manner, which is very difficult to acquire. Children are taught to sit with their left side towards the desk, and the left arm on the desk to hold the copy-book. The desks are not fitted to the size of the children, but are all of the same size, whether the children are tall or short for their age.

Now, this method of teaching is entirely wrong, and is liable to give rise to affections of the following kinds:

1. Curvature of the spine.
2. Eye-strain.
3. Nervous symptoms arising from the great nerve strain involved in carrying out finely co-ordinated movements for which the child has been in no wise prepared.

Many experiments have been carried out with the object of preventing these faults, and there is now considerable agreement with regard to the following points:

1. *The Copy-Book.*—The copy-book should be placed in the direct central position—*i.e.*, straight in front of the child, with its edge parallel to the edge of the desk. This position makes correct posture easy. Placing the book to the right tends to produce bad posture, because the head and eyes are turned to the right, and the spine tends to follow; the left shoulder is raised, and the eyes are strained, as the lines in the copy-book and the point of the pen cannot be focussed so easily as when the book is placed directly in front.

2. *The Pen.*—The direct central position is sometimes objected to on the ground that the hand is in the way of the eye, and that the child will droop the head to the left in order to see the pen. This is true if the pen is held in the unnatural way taught by the old writing-masters—that is to say, with the fingers stiff, the palm of the hand directed towards the paper, and the penholder pointing to the right shoulder. This method of holding the pen

involves great muscular strain, and ought to be discarded. The pen should be held about an inch from the point, with the holder pointing to the right, and slightly backwards, and the side of the hand directed towards the paper. Children often adopt this position quite spontaneously, and, indeed, often exaggerate it, by directing the pen-holder too far to the right.

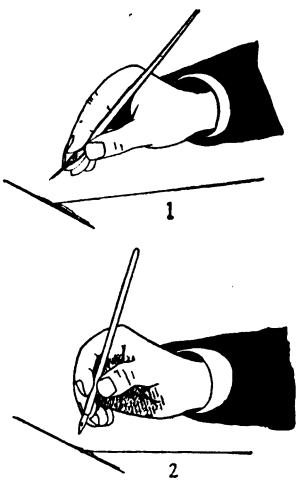


FIG. 19. Methods of holding pen. 1. Difficult and wrong. 2. Easy and right.

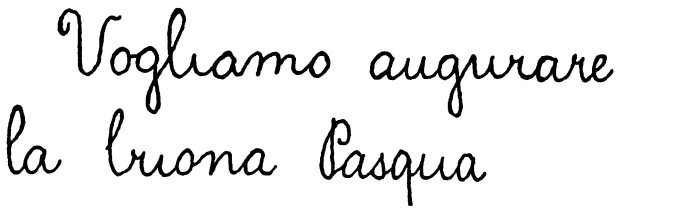
3. *The Script* ought to be vertical, because vertical script is natural in this position, and because it is less trying to the eyes, horizontal and vertical lines being more easily focussed than sloping ones.

4. *Posture*.—The teacher must attend to the posture of the pupils. Vertical script makes good posture easier, but will not compel a pupil to sit in the correct posture, especially if the desks and seats are unsuited to his size.

5. There still remains the fact that writing involves a *very fine co-ordination of movements*. The pen is guided by movements of the small joints of the fingers and thumb. The head and eyes also require to be kept very accurately in position in order that the point of the pen may be clearly focussed. The effort to adjust all the required movements accurately to one another is very great, quite different from that required for the large free movements to which the child has been accustomed. The recognition of this fact has led to the attempt to prepare the child for writing by free arm drawing. At the kindergarten stage the children draw on blackboards with crayon. The thick

crayon is easy to hold, the eyes are not strained by watching a fine point, and the movements are free. It is an easy transition from such drawing to writing, the letters at first being made of large size—in fact, just as large as the child chooses. This plan is good, being on the line that education should follow the natural order of the child's development. The results, however, have not been quite so satisfactory as might have been expected with regard to writing in a copy-book. Possibly the transition to pen and copy-book has been too sudden, and there ought to be an intermediate period of writing on coarse paper with a blunt crayon or thick pencil.

A further advance in the teaching of writing has recently been made by Dr. Montessori. In her infant schools in Rome this lady made use of script letters 3 inches high, cut out of coarse sandpaper. The children were taught to feel these and recognize them by touch. They regarded this as a game, and by constantly passing their fingers over the letters they unconsciously acquired the movements necessary for writing; and Dr. Montessori found that, in course of time, the children began to write quite spontaneously, and with such enthusiasm that it was difficult to keep them from covering every available surface with writing. The specimen here shown is taken from a letter written by a child of five* (one-fourth reduction).



* *The Montessori Method* (Stokes).

CHAPTER VII

THE CIRCULATORY SYSTEM

THE usual description of the circulation sounds somewhat mechanical, and necessarily so. The body is a machine, and as such is subject to the laws of mechanics. The circulatory system is an elastic, hydraulic apparatus, and the blood flowing through the vessels is subject to the same laws as water flowing through a series of elastic tubes. But although the circulatory system may be compared accurately to an elastic force-pump forcing fluid through elastic tubes, we must remember that the whole apparatus is also vital, and subject to the laws which govern muscles and nerves. The heart itself is a hollow muscle. The walls of the bloodvessels contain a large proportion of muscle fibre. The whole apparatus is under the control of the nervous system. The result of this control is that the amount of blood passing to any part can be nicely regulated according to requirements.

An organ actively functioning requires more blood. Accordingly we find that, when an organ becomes active, the bloodvessels supplying it become relaxed so that more blood flows to it, while in other parts of the body the bloodvessels contract, and the blood-supply is diminished. It is a common experience, for example, that during active brain work the feet are apt to become cold. After a heavy meal one is apt to feel sleepy, or to find it difficult to engage in mental work, because the increased flow of blood to the stomach diminishes the circulation in the brain.

Sometimes, however, this local regulation is insufficient. There may, as in active exercise, be a call for an increased supply of blood to all parts of the body. This is brought about by quickening the flow. Blood is brought more rapidly to the heart; the heart beats more rapidly, and the pulse is quickened.

Moreover, the circulation of the blood is assisted by the movements of the body. Every time a muscle contracts it compresses the bloodvessels in its substance, and thus helps to drive the blood onward towards the heart.

The movements of the chest also assist the circulation. Every time a breath is drawn the expansion of the chest tends to draw blood into the heart in precisely the same way as air is drawn into the lungs. Expiration, on the other hand, by increasing the pressure within the chest assists the heart to drive the blood into the arteries beyond.

The Hygiene of the Circulatory System.—We are all aware that in adult life heart disease is not uncommon, and that it is of serious consequence, often ending as it does in sudden death. The heart and bloodvessels are usually healthy during childhood, but heart disease is by no means unknown, and when it does occur it is even more serious than in the adult.

The proportion of children found on medical examination to suffer from heart disease is about 1 per cent. An important point about these cases is that as a general rule the existence of the disease was unsuspected by the parents or teachers, and consequently no precautions were being taken to prevent it getting worse. Some medical inspectors report a much larger prevalence of heart disease —2, 3, or 4 per cent. That is because they have included not only cases of disease of the valves, which is what is usually meant by heart disease, but cases of weakness or dilatation of a temporary nature. It is important that these latter cases should be discovered and looked after.

Heart disorders in children arise from three chief causes—congenital conditions, rheumatism, and strain.

1. *Congenital Disorders* of the heart may be due to disease or to malformation. Very often children so affected die in infancy. Occasionally complete recovery takes place. Occasionally, also, the child survives and comes to school, although suffering from the disease, but such cases are very rare. Children so affected are usually quite obviously delicate. Their skin has a bluish color; indeed, their face and hands may be deep blue. Their finger-tips are swollen or clubbed. About such children it is sufficient to say that they must be tenderly treated, and protected in every way from cold, damp, and over-exertion. They must never be hurried or allowed to carry weights. They must take their own time in going up-stairs. They must sit out at drill.

2. *Heart Disease*, when the term is used in a restricted sense, generally signifies disease of one of the valves which regulate the flow of blood. Either the valve becomes narrowed, so that the heart has to labor unduly in order to drive the blood through, or it becomes "incompetent," so that, when the heart contracts, it allows the blood to flow back in the way it should not go. Heart disease of this kind is always serious. It is usually progressive. It adds to the danger of every illness. It is itself frequently fatal sooner or later. Yet much can be done to delay its progress; much, also, to prevent its occurrence.

Valvular heart disease is due to various causes, but a long way the most frequent cause is rheumatism, of which, be it remembered, chorea is a manifestation (p. 69). *Rheumatism* is due to a germ which gains entrance through the throat, and it gets its chance when the vitality is lowered by cold and damp. Acute tonsillitis is often rheumatic. If children were always kept warm and dry; if they were never allowed to sit with wet stockings; if sore throats were

always attended to; if diseased tonsils were always removed —much heart disease would be prevented. That such preventive measures are really useful is shown by the fact that rheumatism and heart disease are much less common among the rich than amongst the poor.

3. *Heart Strain* is a danger to which the normal healthy child is very little exposed. It is, however, a real danger in childhood. Delicate children are liable to heart strain from an amount of exertion which would not injure a strong child, but as a general rule such children are unwilling to exert themselves beyond the limits of safety. A much greater risk is run by children who are convalescent from some febrile ailment. Influenza, diphtheria, and scarlet fever are specially apt to leave the heart in such a weakened condition that it readily becomes dilated under the influence of exertion. Now, a dilated heart works at a great disadvantage. In an adult a slight degree of dilatation may cause no symptoms beyond a tendency to get out of breath too easily on exertion, but in a child the symptoms are often more serious. Not only is the child unduly short of breath, but he is easily fatigued mentally and bodily, and his nutrition is apt to suffer. Moreover, the condition may be progressive, and overstrain may cause permanent damage to a heart which ought with care to have made a complete recovery.

The danger of heart strain, then, is associated with quite ordinary degrees of exertion in the case of convalescent children, and when such children come back to school, a careful eye should be kept upon them. In the case of healthy children, strain may result from overexertion at work or from athletics. Message boys are often expected to carry loads which are much too heavy for them. If boys *must* deliver heavy loads, light hand-carts should be provided for them by their employers.

The Circulation in Relation to School Life.—Exercise increases the rapidity of the circulation. Count a boy's pulse, send him to run round the playground, and count again. Note the increase. It will be found by no means inconsiderable. This fact may be taken advantage of on many occasions in school work. For instance, on a cold day the children may be suffering from cold hands or feet. Now, no one, the least of all children, can do good mental work when suffering from bodily discomfort. The proper way to overcome this discomfort is by exercise, not by warming the cold members at the fire. It should be remembered, then, that children's brains will work better if their feet and hands are warm.

In another section it is stated that fatigue is due in part to the formation of poisonous waste substances. Now, young children tire very quickly when put to unaccustomed mental work and it is found in actual practice that it is economical to alternate short spells of mental work with bodily exercise. A little active bodily exercise quickens the circulation, which has the double effect of washing away the fatigue poisons and of increasing the activity of the brain.

The question of heart strain scarcely arises in connection with any reasonable form of exercise, except in the case of children with weak hearts. The heart of the child is relatively larger than that of the adult, and the blood-vessels are healthy and highly elastic. Consequently the organs of circulation are quite fit for the increased work which all exercise involves, and gymnastics of a reasonable kind and energetic games and sports rarely do anything but good. The physical exercises best adapted for young children are those which do not involve great effort, such, namely, as marching, musical drill, or childish games. For older children we should aim at the development of skill rather than endurance.

Athletics and Heart Strain.—The great value of athletics for growing boys is universally admitted, and headmistresses of most modern girls' schools consider organized gymnastics and games a necessity for the healthy development of girls. From time to time, however, the question is raised of the danger of heart-strain, and, as the danger is a real one, it is important that all possible precautions should be taken against it. Before speaking of such precaution, however, it will be of interest to refer to an inquiry which was carried out by Dr. Morgan with reference to the University "oars" who took part in the Oxford and Cambridge races between 1829 and 1869. Of these 255 were alive at the end of 1869. In response to his inquiries, Dr. Morgan has replies from 251, and heard of the remaining 4. The results of his inquiry were decidedly favorable to the rowing men, so far as they bore on the expectation of life. The ordinary expectation of life of all the oarsmen rowing in 1829 had been markedly exceeded. It may be added that the rowing men distinguished themselves intellectually in the number of honors gained over those who had not rowed for their Universities.

Precautions against Heart Strain.—The following precautions may be regarded as authoritative, as they are based partly upon the recommendations of the *Medical Officers of Schools Association*, and partly on the results of a discussion between doctors and headmasters in Edinburgh in 1910:

1. Boys and girls should be graded according to physical ability.

2. Physical ability should be determined by the results of medical examination.

3. Hard exercise should not be taken for at least an hour after meals.

4. Strenuous athletic exercises should not be permitted without sufficient preliminary gymnastic training.

5. In connection with severe exercise, strict rules as to changing and drying of clothing should be enforced.

6. Exercise should be supervised by games-masters and carefully selected school captains and prefects.

7. After illness special caution is necessary as to the resumption of exercises. It is also to be remembered that a boy may conceal the fact that he is feeling unfit because he wants to take part in a game. This is very liable to occur when influenza is prevalent.

8. A special danger attaches to long-distance racing, and to rowing, swimming, and cycling races. The quarter-mile race, run at top speed from start to finish, involves special strain and risk of serious exhaustion. Only a few of the stronger and older boys should be allowed to compete for the longer races, and these should be carefully selected by the master and the medical officer. Competitions in long-distance swimming are dangerous for young adolescents.

9. Cross-country runs and paper-chases should be distinguished from races. They should not be competitive or run against time, but should be done walking and running alternately.

The Care of Children suffering from Heart Disease.—The discovery of heart disease rests with the doctor. Disorders of the lungs usually reveal their presence by cough or other symptoms, but heart disease may for a long time give rise to no symptoms likely to cause anxiety, or even to attract attention. Undue breathlessness on exercise, and a slight tendency to blueness of the fingers or the face, are signs of a weak circulation, but do not necessarily depend upon diseases of the heart. All children suffering from heart weakness require special care, and precautions should therefore be taken in the following cases:

1. Children known to have heart disease or a weak heart.

2. Children who have had rheumatism in any form.
3. Children who have had chorea (St. Vitus's dance).
4. Convalescent children, especially after influenza, diphtheria, and scarlet fever.
5. Children who have an undue tendency to blueness or shortness of breath.

The necessity of safeguarding such children against rheumatism has already been referred to. Apart from that, the main thing to guard against is overexertion. Children suffering from heart disease should not be allowed to carry heavy loads of books, or to engage in strenuous games. Cycling is particularly dangerous, and even stair-climbing should be minimized. Prolonged standing also puts a strain upon the heart. It need not be supposed, however, that disorders of the heart debar a child from all exercise. On the contrary, in many cases suitable exercise is distinctly beneficial. But the amount and kind of exercise suited to the case must be determined by medical examination. The child's capacity for exercise, and his desire for it, are no guide at all. A very instructive example of this is found in one of Dr. Kerr's reports. Two boys whose hearts were somewhat dilated were allowed to join their companions at a holiday camp, being warned against overexertion. On returning from their holiday it was found that all the boys had improved in health and increased in weight except the two mentioned, and these two were found not to have benefited in any way.

THE LYMPH AND LYMPH GLANDS

Lymph is a watery fluid which plays the very important part of a messenger between the blood and the tissues of the body. It is derived from the blood, and, after percolating through the tissues, it finds its way back to the blood again. On its way most of it filters through little

masses of lymphoid tissue—the kind of stuff the tonsils are made of—about the size of a pea or bean. These are the lymph glands, and they have two functions—(1) They manufacture white blood-corpuscles, which the lymph-stream carries to the blood; and (2) they protect the body by straining off from the lymph any noxious matter or disease germs which it may happen to contain. The latter function, unfortunately, is rather a dangerous business for them, for it frequently results in their becoming diseased.

Disorders of the Lymphatic System.—Delicate inactive children frequently have a somewhat puffy appearance, which is due to the stagnation of the lymph. This does not result from any disorder of the lymph vessels, but is due to the feebleness of the circulation and the watery condition of the blood, and is an indication that the child requires tonic treatment.

Enlarged Glands.—In statistics showing the prevalence of disease among school-children, "enlarged glands" always occupy a prominent position. The significance of enlargement of the lymph glands is twofold—

1. Enlarged glands are generally an indication that there is something wrong somewhere else, some source of irritation which ought to be found out and treated. Decayed teeth are a specially important source of such irritation in the case of school-children.

2. The glands themselves may require treatment. They may be infected by the tubercle bacillus, in which case they are liable to break down and form troublesome sores. But enlarged glands are not always tubercular. Frequently they become inflamed owing to some other infection, which, if not checked, may lead to the formation of an abscess, or even to blood-poisoning.

Position of Enlarged Glands.—Enlarged glands often feel like little knots under the skin. They are apt to be more or less tender according to the amount of inflammation

which is present. They are found in definite situations, such as the front of the elbow or in the arm-pit; behind the knee or in the groin. In all these cases the cause of the enlargement is usually some sore in the limb lower down. The most frequent site, however, is the neck—at the back (*e.g.*, in cases of dirty or inflamed scalp), at the side (due, *e.g.*, to running ear or sore throat), or under the jaw (due to ulcerated lips or gums or to decayed teeth).

Significance of Enlarged Glands.—Enlarged glands may attract the attention of the teacher if they happen to be large enough to cause visible swellings, or if the skin over them is inflamed, or if they are so tender as to interfere with the child's freedom of movements. ***All such cases require treatment,*** which is very apt to be neglected, especially if there is little or no pain. The teacher can therefore be of service in calling the attention of the school nurse or doctor to children affected in this way.

CHAPTER VIII

THE HYGIENE OF RESPIRATION

FRESH air is just as essential to life as food. Food supplies energy to the body in precisely the same way that coal supplies energy to the steam-engine. The oxidation of food in the body is the same process chemically as the oxidation of coal in the engine, except that it takes place more slowly. A child's warmth and energy, therefore, depend not only on food, but on oxidation, and oxidation depends on respiration. During respiration the air parts with oxygen, and the body with carbonic acid, one of the final products of oxidation, thus:

	Atmospheric Air. Per Cent.	Respired Air. Per Cent.
Oxygen	20.9	16.2
Nitrogen	79	79
Carbonic acid	0.04	4.34
		+ water vapor.
		+ heat.

Healthy children breathe freely and naturally through the nose. The respiratory movements are abdominal till about the seventh year, after which they gradually become costo-abdominal. When the child is at rest, the respiratory movements are comparatively slight, because the demand for oxygen is not great; but during active movement, respiration at once becomes quicker and deeper. This reserve respiratory power is very considerable, so that the child can run about freely without easily becoming short of breath. A child's capacity for active exertion is

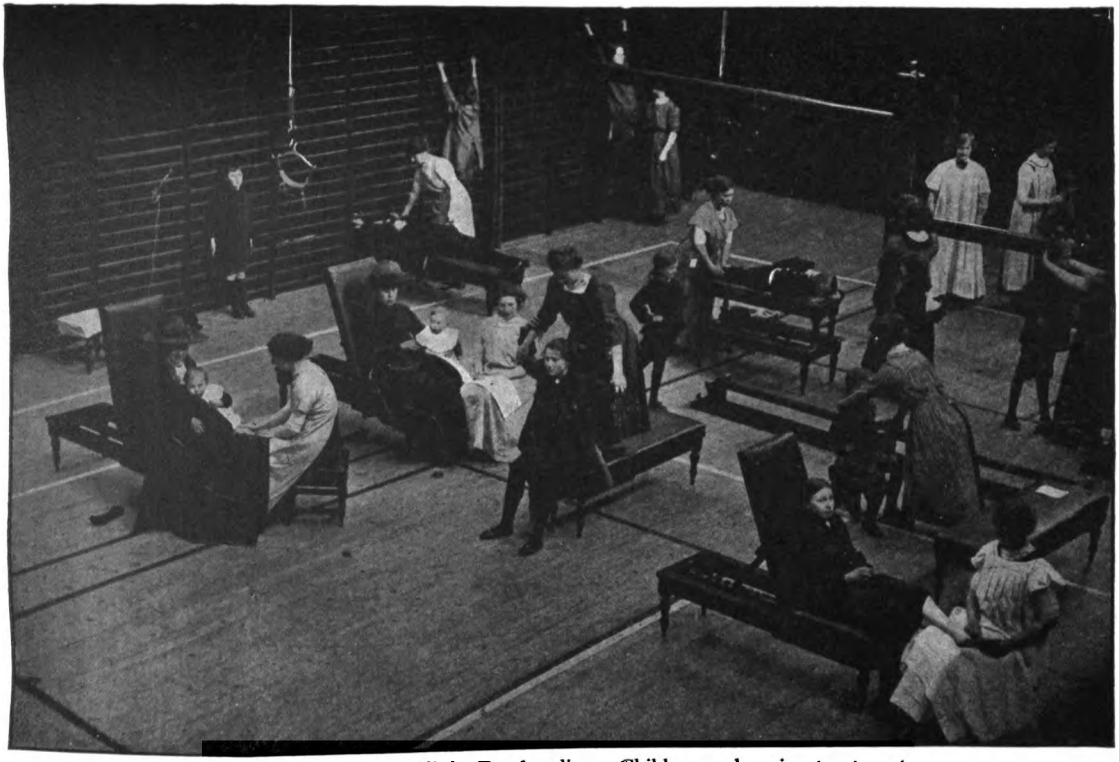


FIG. 20. Orthopædic Clinic, Dunfermline. Children undergoing treatment.

dependent on his ability to breathe freely when the body demands more oxygen. There is much significance in such a phrase as "sound in wind and limb."

A child may suffer from want of fresh air, owing to too much confinement to the house, or to bad ventilation at home or at school. But children may also suffer in a similar way, owing to conditions which prevent the free entrance of air into the chest. Of such conditions, the most common is *nasal obstruction*. If the nose is blocked, the child is compelled to breathe through the mouth, and mouth-breathers may be recognized in almost any class of children. Mouth-breathing is commonly due to partial or complete blockage of the nose. It is sometimes due to a bad habit, which has been acquired perhaps as the result of repeated colds. The causes of nasal obstruction will be considered later.

Mouth-breathers suffer in three ways: —

1. Air ought to be warmed and filtered by passing through the nose. The child who breathes unwarmed air runs a greater risk of bronchitis, to which mouth-breathers are very subject.

2. The mouth-breather tends to revert in sleep to the natural nasal respiration, but as air cannot enter freely through his nose, he gets an insufficient amount of oxygen, and his sleep is not refreshing, so that he seems dull and sleepy in school.

3. This difficulty in drawing air through the nose results in great respiratory efforts, but these efforts, instead of filling the chest with air, as they would do were there no obstruction, often lead to deformity of the chest, especially if the ribs are soft, as they are apt to be in young children.

There is a more artificial interference with the entrance of air into the chest—namely, clothing. The wearing of corsets interferes with abdominal respiration, and prevents the expansion of the lower part of the thorax. This is

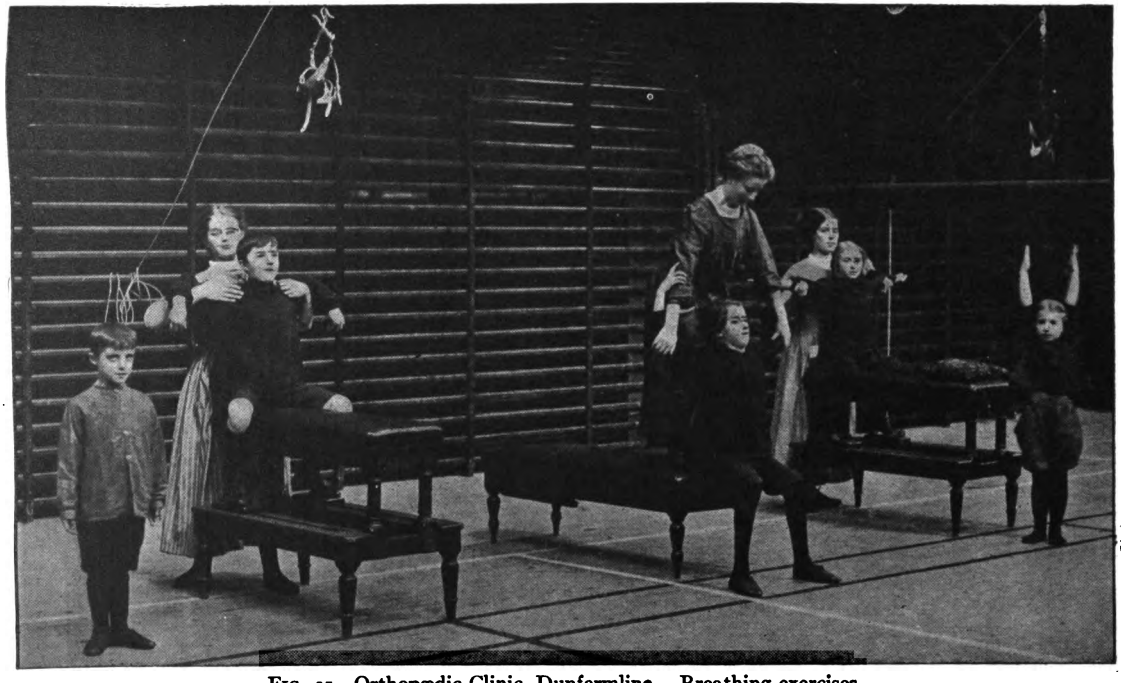


FIG. 21. Orthopædic Clinic, Dunfermline. Breathing exercises.

partially compensated by increased movements of the upper part; hence the breathing of women is commonly thoracic in type. In women who have never worn corsets breathing is costo-abdominal, as in men. That corsets interfere with free breathing is shown by an experiment tried at Bournville in 1910. Eleven girls not used to wearing corsets ran a race of 540 yards without corsets. On the following day they ran again with corsets. On the first occasion the average pulse-rate was increased by the race from 83 to 152·5; on the second from 83 to 168·7—a rise of 16 beats per minute owing to corset wearing. This was not due to tight-lacing, as the average waist measurement was decreased by a negligible fraction (0·06) of an inch. Yet these corsets diminished the girls' breathing capacity so much as to lead to increased labor of the heart.

Affections of the Lungs.—Although children are very liable to diseases of the lungs, it is not very common to find children so affected attending school. In the case of acute affections, such as bronchitis or pneumonia, the children are too ill, while less acute affections give rise to a cough, so that the doctor is consulted, or at any rate the child is kept at home.

Bronchitis sometimes occurs in a chronic form, which allows the child to go about. This form is especially common in young children who have suffered from rickets. Such children are always catching cold, and whenever the weather is cold and damp, they develop a cough and wheeze. Often they are far too warmly dressed, because their mothers pile clothes upon them to keep them from catching cold, with the result of making them more sensitive than ever to changes of temperature. The treatment of such children is referred to elsewhere.

Consumption is the name commonly given to *tuberculosis* of the lung. The tubercle bacillus, the cause of all forms

of tuberculosis, is a minute organism, $\frac{1}{8000}$ inch in length, which was discovered by Koch in 1882. It may attack any part of the body. In early childhood the parts most frequently attacked are the lymph glands, especially those in the abdomen; the membranes of the brain, causing tubercular meningitis; and the bones and joints. All these forms are very common, but it is a mistake to suppose that consumption is a form which affects adults only. On the contrary, of 21,873 cases of consumption notified in London in 1912, no less than 14·9 per cent. were children of five to fifteen years of age. Moreover, in many adult cases the disease really began in childhood. In fact, consumption is often a chronic and insidious disease. The symptoms may be comparatively slight, so that children suffering from the disease may be found attending school. The proportion of children affected is not certain, but a good many school doctors have found from 1 to 2 per cent. of children with symptoms of active disease.

While the cause of consumption is always the tubercle bacillus, many predisposing causes play a part. One of the most important of these is *heredity*, the influence of which there is a tendency at present to underrate. Everything that lowers the general vitality also renders a child more susceptible to tuberculosis. Under this heading *poverty*, *measles*, and *whooping-cough* are specially important. The bacillus gains entrance to the body chiefly by respiration, but milk from tubercular cows is also an important source of infection.

Prevention of Tuberculosis.—Efforts to prevent tuberculosis may be made in two directions—*to increase resisting-power*, and *to diminish the risk of infection*. Children's resisting-power can be increased by good food, and sufficient sleep, and abundance of fresh air. The success of the open-air sanatorium in the treatment of consumption is a proof that fresh air must be of value as a prophylactic,

and the lesson learned from sanatorium experience can be, and should be, applied to schools. Medical inspection will doubtless do much to diminish the risk of children being affected by a consumptive class-mate, and the teacher should see that any child who suffers from a persistent cough is brought under the notice of the school doctor. The children should receive instruction, formally or informally, as to the dangers of dust, and of spitting, and the disinfecting value of sunlight and fresh air.

Children actually suffering from consumption should not be treated in a sanatorium for adults, but in a sanatorium school, where they can be kept for a long period, and educated at the same time. Money could be economically spent in this way, and would ultimately give a good social return, whereas it has been calculated that London has been spending £33,000 a year in educating children who died of tuberculosis before they could reap the benefit.

The Hygiene of Respiration.—The hygiene of respiration may be summed up in two phrases—*deep breathing* and *fresh air*. Deep breathing is essential for the proper development of the lungs and chest. Nature provides for this by prompting children to run about and play games which necessitate deep breathing. But a considerable proportion of children, especially in towns, have poorly developed chests. Many of them rarely play active games in the open air. For such children, respiration drill is of great value, and should be regarded as the essential part of all drill. It should be preceded by the use of a handkerchief, so as to clear the nasal passages. It should be practised not only as part of the drill lesson, but daily with windows open, as part of any "three minutes' exercise" taken as a relief between lessons. It should be done slowly, yet in the child's own time. And the teacher should remember that full expiration is as important as inspiration, and that the children should not be allowed to

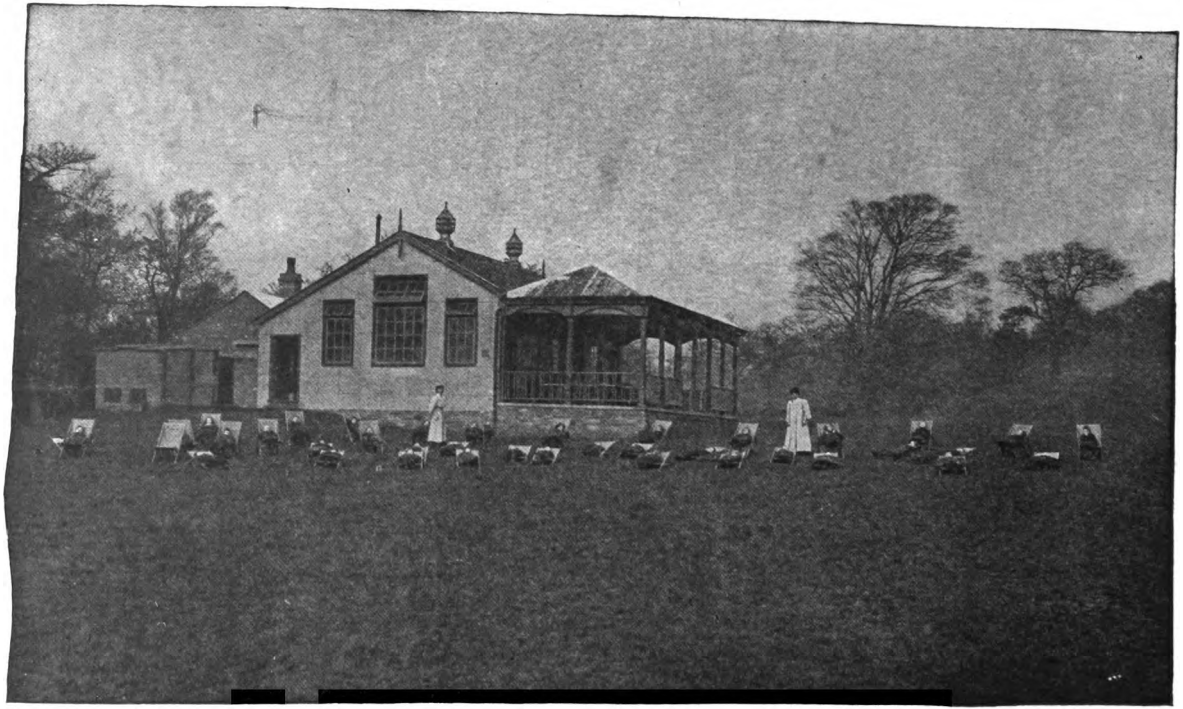


FIG. 22. A Fresh-air school. (From Dr. Crowley's *Hygiene of School Life*.)

hold in the breath with the idea of "making a chest," as ambitious boys are sometimes apt to do.

While all children benefit by abundance of fresh air, there are many weakly and backward children whose needs in this respect cannot be met in ordinary schools. For such children the first open-air school was opened at Charlottenburg in 1904, and the experiment was so successful that a number of similar schools have been opened in this country. The children spend the entire day at school, where they are provided with three substantial meals. Lessons are given either in the open air or in open sheds or verandas. The children selected are suffering from such conditions as malnutrition, bloodlessness, enlarged glands, adenoids, heart disease, eye affections. They attend the school for at least three months, perhaps six, or more. It is found that as a general rule the health of the children improves greatly, and there is often a similar improvement in their mental alertness, and in their behavior. The fresh-air principle is also applicable to children attending ordinary schools. Playground classes have been held for several years in connection with the London County Council Schools, with very satisfactory results.

CHAPTER IX

THE EYE AND SIGHT

Sight.—Sight is a function, not of the eye, but of the brain. More accurately, sight, in the sense of perception, is a function of the mind. It is a complex function which is perfected by degrees. Children can no more see clearly without experience than they can read without being taught. Hence the instinctive desire of young children to handle everything, so that sight and touch sensations may co-operate in developing the power of perception. When sight is tested by teachers, young and weakly children are sometimes picked out as notably defective, whose eyes are found, on expert examination, to be quite normal. Yet the defect of sight is really present, and is due to the imperfect development of the centre for vision in the brain, owing partly to poor health, partly to non-use of the eyes. Perhaps the child has spent most of its time in one room in a tenement, watching languidly what was going on, but never observing anything minutely. The development of sight, then, depends upon the use of the eyes. What is commonly called the "training of the senses" is very largely a training of the mind through the senses. But mental training inevitably suffers if the organs of sense are not properly used and properly taken care of.

Dangers to which the Eye is exposed.—The eye of the child is exposed to danger of three kinds—*injury*, *infection*, and *strain*.

1. With regard to **injury**, it is unnecessary to enter into

particulars beyond saying that any injury to an organ so delicate as the eye should receive immediate skilled attention.

2. **Infection,** on the other hand, is a danger which may be overlooked, yet there are several common affections of the eye which are very liable to spread among children. The danger is greatest in the case of weakly or poorly nourished children, and especially when these are crowded together in residential or "barrack" schools. These affections will be referred to later. In the meantime, it is sufficient to say that the teacher should regard any discharge from the eye as probably contagious. Any child so affected should be separated from other children. Neglect of this precaution some years ago resulted in an outbreak, in Aberdeen schools, of contagious ophthalmia, during which 7,787 cases were treated at the eye institution. Infection may spread from one child to another by means of towels, handkerchiefs, contaminated fingers, or even water in swimming-baths.

3. **Eye-strain** is closely associated with school life. This association is very clearly indicated by the experience of Germany, where shortsightedness is much more common than with us. The proportion of shortsighted children increases with every year of school life, and is much higher among the educated classes than among those who leave school young. The greater proportion of shortsightedness in Germany than in England and France is attributed to the trying nature of German type.

The evil effects of eye-strain are not limited to injury to the eye. Eye-strain involves severe nervous effort, and is liable to give rise to nervous symptoms, sometimes of a serious nature. It is, moreover, a very important fact that children who are subject to eye-strain often make no complaint. There is, therefore, the greater need to

eliminate from school work all unnecessary causes of strain, and to discover and safeguard those pupils who are most subject to danger of this kind.

What Teachers should observe.—The teacher should carefully observe any children in the class who appear to have any affection of the eye. Styes, squints, and redness of the eyelids readily attract attention, but in addition a lookout should be kept for children who seem unduly sensitive to light, who screw up their eyes in looking at the blackboard, who stoop down to their work, or lift their books up to their eyes.

Common Eye Affections—1. *Blepharitis.*—This is an inflammation of the edge of the eyelids often called "red eyes." The eyelashes are often scanty, and there is a sticky secretion which forms crusts on the lids. The condition is common after measles. The eyes often feel sore, and are easily tired. The crusts should be removed daily after bathing with boracic lotion, and a little suitable ointment applied. The administration of cod-liver oil or chemical food is aften helpful.

2. *Stye.*—A stye is a little abscess which forms on the margin of the eyelid. Sometimes styes occur in groups, especially in children whose health is below par. Frequent bathing in warm (not hot) boracic lotion is useful. Poultices should never be applied to the eye for this or any other condition.

3. *Acute Conjunctivitis.*—This is an inflammation of the thin membrane which lines the eyelid and covers the white of the eye. It is contagious, and may spread rapidly through a school. It causes pain and increased sensitiveness to light, and there is a yellowish discharge. There are several varieties of the affection, which differ in virulence, but in all cases the affected child should be kept at home. The eye should not be tied up, but should be pro-

tected from strong light and bathed frequently with boracic lotion. Medical treatment should be secured early (*vide* p. 124).

4. *Chronic Conjunctivitis* may follow (3). It is also a common sequel of measles, usually associated with blepharitis. Bathing with *cold* boracic lotion is useful in slight cases, but often more astringent applications are required.

5. *Keratitis*, or inflammation of the cornea, occurs chiefly in children of ten to fifteen. The cornea becomes hazy, like ground glass. Such children require medical treatment.

6. *Corneal Ulcers* cause pain and great sensitiveness to light. Children affected are unfit for school, as their eyes require complete rest. When such ulcers heal, they are apt to leave a hazy *nebula* or a white *opacity* on the cornea, thereby causing partial or complete blindness.

7. *Squint* cannot escape detection if it is marked, but a lookout should be kept for slight or occasional squint among the younger children, as early treatment may prevent loss of sight in the squinting eye. Such squints are often due to *hypermetropia*, or longsightedness, as is explained under that heading.

In all these conditions it is easy to see that something is wrong. We have yet to consider the common "errors of refraction," of which shortsightedness is an example, which require to be searched out, because there is often little or nothing to attract attention. In all such cases the eye is unable, or able only with greater difficulty than normal, to form a clear image on the retina.

Errors of Refraction.*—The common errors of refraction are illustrated in Fig. 23, which should be studied carefully, as the subject is a little difficult to understand.

* For the "Structure of the Eye," see author's *Physiology*, chap. xv. A textbook on *Optics* may also be consulted by those who find any difficulty in understanding the description in the text.

Diagram *A* represents the *normal* eye at rest. The rays of light from a distant object (any object more than 20 feet from the eye) which fall upon the pupil are practically parallel, and are brought to a focus on the retina. Conse-

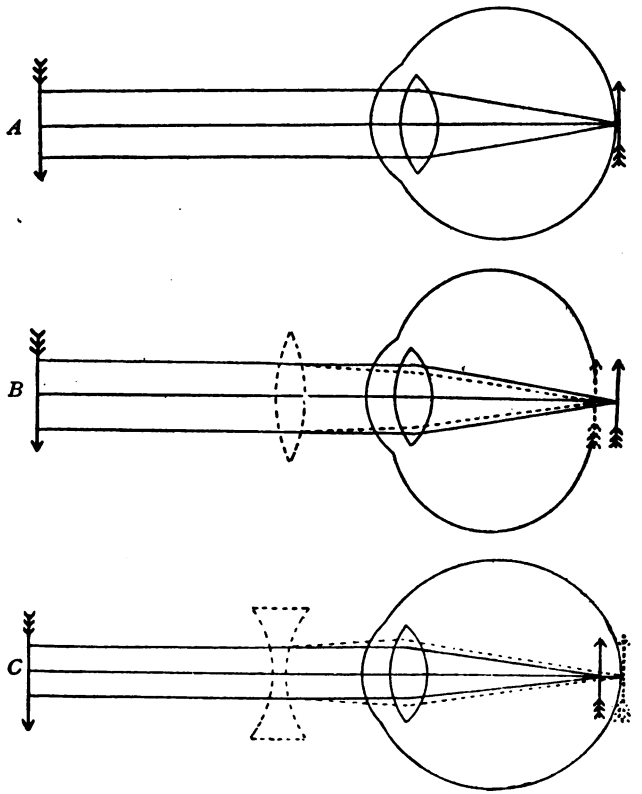


FIG. 23. Refraction of Eye. (From *The Body at Work*, by Dr. Alex. Hill.)

quently distant objects are seen clearly without any effort of accommodation. But when an object is brought near the eye, the rays of light which fall on the pupil from every point on the object are divergent, and therefore must be

bent more strongly if they are to be focussed on the retina. Accordingly accommodation takes place—that is to say, a small muscle within the eye contracts, with the result that the lens becomes more and more convex until the object is focussed clearly on the retina.

Diagram *B* shows the *longsighted* or *hypermetropic* eye. This eye is too short from front to back. Consequently, when the eye is at rest, parallel rays of light are not sufficiently bent by the lens to be focussed sharply on the retina. To bend them sufficiently accommodation is necessary. A longsighted person, therefore, must accommodate to see a distant object clearly; to see a near object clearly he must accommodate more strongly than a person with normal eyes. Near work in such cases puts a great strain upon the eyes. This strain can be relieved, as the diagram shows, by a convex lens, which assists the lens of the eye to bend the rays of light.

Diagram *C* shows the *shortsighted* or *myopic* eye. This eye is too long from front to back. Consequently parallel rays of light are brought to a focus in front of the retina. The image of a distant object on the retina is therefore blurred, and distant objects cannot be seen clearly. Accommodation would only make things worse, but a concave lens, as the diagram shows, causes the rays to diverge slightly before they enter the eye, and thus a clear retinal image can be formed.

Astigmatism is a common defect in which the cornea, or rarely the lens, is not equally curved in all directions. The eye may be normal in one plane, and myopic or hypermetropic in another. The result is a distorted image on the retina similar to what may be seen in an exaggerated form by looking at the image in a polished spoon.

The *frequency* with which errors of refraction are met with in school-children is indicated by the following figures from Dr. Mackenzie's report already referred to: Normal,

45·33 per cent.; hypermetropia, 28 per cent.; myopia, 6·5 per cent.; astigmatism, 20·17 per cent.

Hypermetropia is thus the most common anomaly, and it is especially common among the younger children. The reason for this is that the eye is normally hypermetropic in infancy, but as it grows it alters in form, and the hypermetropia disappears. Consequently slight cases of hypermetropia in young children do not require treatment, but the fact that a considerable proportion of the younger children in any school are sure to be somewhat hypermetropic shows the necessity of caution with regard to near work.

A high degree of hypermetropia necessitates a severe effort to accommodate in order to see clearly, and this effort not only causes eye-strain, but has a tendency to produce another effect. Accommodation is associated with convergence of the eyes. Thus, if any one accommodates very strongly to see a very near object, such as the tip of his nose, excessive convergence will also take place. In other words, he will squint. In children suffering from hypermetropia, the severe effort of accommodation is apt to set up a spasm of convergence, and this is a very common cause of *squint*. At first the squint may occur only occasionally, but it is apt to become permanent, and the sight of the affected eye may then become impaired. Consequently whenever a young child is noticed to squint, even occasionally, immediate steps should be taken to have the child's eyes examined, and if spectacles are ordered, the teacher should see that they are worn constantly. Squint may also arise from other causes, such as inequality between the eyes. This inequality can often be corrected by glasses.

Myopia, or *shortsightedness*, is comparatively uncommon among the younger children, but becomes more frequent with advancing age. Dr. Mackenzie found 3 per cent.

among boys of six to nine, 6 per cent. in boys of nine to twelve, and 11 per cent. in boys of twelve to fifteen. Dr. Dukes found 12 per cent. in the Rugby boys of twelve to fourteen. Myopia is caused by eye-strain, and school conditions have a great deal to do with the number and severity of the cases. The liability to the condition is strongly influenced by heredity.

In some cases of extreme shortsightedness, the children cannot follow the ordinary class-work without danger to their sight. The best thing for such children is to be taught reading and writing in a special class by means of charts and blackboard work, but without the use of books. They may join the ordinary classes for oral lessons and some kinds of manual work.

Spectacles and how to Use Them.—The invention of spectacles is attributed to Salvino d'Armati of Florence, who died in 1317. At one time a pair of glasses cost the equivalent of £10 to £20 of English money. Men paid that price for them because they were worth it. They are worth more to-day, though they cost less. Many men are earning high wages who, but for their glasses, would earn little or nothing. Dr. Oliver calculates that glasses increase the wage-earning power of Bradford by over £40,000 a year. But glasses may be worth more to a child than to an adult because they may mean a better education, the preservation of eyesight, and a better future position. Yet in most schools there are children who need glasses but have none, and others who, having them, use them not, or use them wrongly.

Glasses should always be prescribed by a competent medical man, not by an optician—*i.e.*, a man who sells spectacles—otherwise there is a risk that glasses may be worn which will strain the eyes even though they may improve the sight. Written or printed directions as to when the glasses are to be worn should be supplied by the

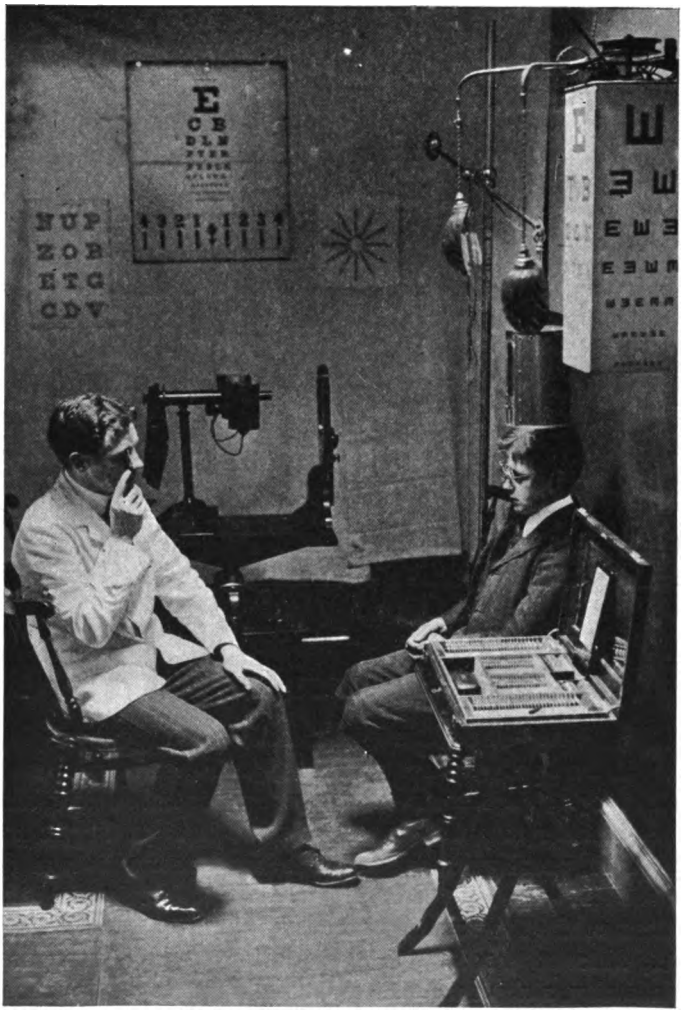


FIG. 24. An eye clinic, showing sight tests on wall.

prescriber, but as this is usually neglected, and as children often do not know when their glasses should be worn, the teacher should (in the absence of contrary directions) be guided by the following rules:

Glasses which have been ordered for squint *must* be worn constantly both at work and play. Failure to obey this rule rigidly may prevent recovery from the squint.

In all other cases glasses prescribed by a doctor *may* be worn constantly, and ought to be worn constantly for class-work, or for any sort of near work at home. When the child is at play, however, the glasses need not be worn provided the sight is sufficiently good without them. On the other hand, there is no objection to the glasses being worn during play except the danger of breakage.

All children wearing glasses should be re-examined periodically—say, every two or three years if no time has been prescribed—as glasses which were quite suitable when first ordered may be unsuitable or unnecessary a few years later, owing to changes in the eye.

HOW TO TEST SIGHT

Requisites.—A Snellen's test card, a weak magnifying lens, and an astigmatism test. Snellen's card is to be seen in Fig. 25. The letters on the card are of various sizes, and the distances at which they are legible in a good light are indicated, usually in metres. The largest letter is usually marked D. = 60 (*i.e.*, distance, 60 metres), and the smallest letters at the foot of the chart are usually marked D. = 6 (*i.e.*, distance, 6 metres). As legibility depends partly on familiarity, a chart with letters resembling those in a school reader has been prepared for testing young children (Fig. 26). Children who do not know their letters may be tested by means of a chart with E's of the proper size in

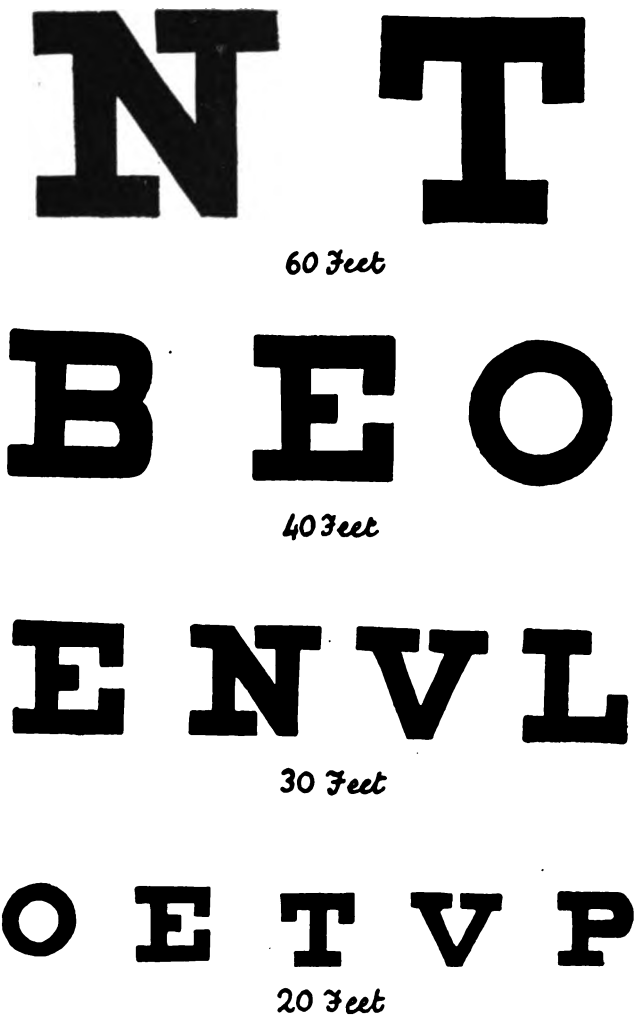


FIG. 25. Test letters. These letters are legible at the distances shown if the sight is normal.

different positions, the child being told to show the position of the letters—*e.g.*, by means of an E cut out of cardboard.

Directions.—1. Hang the test card in a good light.

2. Place the child at a distance of 6 metres (20 feet) from the card.

3. Test each eye separately. Both eyes must be kept open and a card held close in front of the eye not being tested.

4. Tell the child to read as many letters as he can, beginning at the top. If he can read all the letters, his vision is normal. If he cannot distinguish the letters marked D. = 6 at 6 metres, his vision is defective. The amount of the defect is gauged by ascertaining the smallest letters he can see clearly. The result is noted as follows: Suppose the right eye is normal, while the smallest letters distinguishable by the left are those marked D. = 12 or D. = 24, then we note R. = $\frac{6}{6}$, L. = $\frac{6}{12}$, or L. = $\frac{6}{24}$. The numerator of the fraction represents the distance at which the child is standing, the denominator the distance at which the smallest letters he can read ought to be legible.

(*Davidson, London.*)

FIG. 26.

Normal Vision may not mean Normal Eyes.—This is a point of very great importance. Teachers are often asked to examine a class, and report all children whose vision is $\frac{6}{12}$ or worse—*i.e.*, all who cannot distinguish at 6 metres the letters marked D. = 12. This method is successful in picking out the children with defective vision, but it fails to indicate the children who are in greatest danger of *eye-*

strain—namely, those with hypermetropia. A child with a high degree of hypermetropia may have perfect distance vision. Such a child ought to be discovered. Fortunately it is quite easy to do so. All that is necessary is to ask the children whose vision is good to read the smallest (D. = 6) letters through a weak magnifying lens. The children, of course, must stand 6 metres from the chart. *If the lens does not make the vision worse, the child is hypermetropic.* [N.B.—Explain this by reference to Fig. 23.] The lens usually used for this purpose is one with a focal length of 1 metre, called a + 1 D. —*i.e.*, dioptre—lens, which can be obtained from a spectacle dealer for a few pence. Such a lens reveals a very slight degree of hypermetropia. For school purposes it is better to use a slightly stronger lens—*e.g.*, + 2 D. [N.B.—Why?]

Myopia and Astigmatism.—If distant vision is defective, and if there is nothing in the appearance of the eye to account for it (such as a nebula), then there is probably myopia or astigmatism.

Myopia is present if vision is improved by a concave lens.

Astigmatism can be detected by the distortion of vision which it causes. Lines which run in different directions cannot be sharply focussed at the same time by an astigmatic eye. If lines of equal thickness are looked at, those which are out of focus will be slightly blurred, and therefore will appear thicker than the others. Thus, if these discs are

held at arm's length, they will not appear of equal blackness (which they really are) if astigmatism is present. Various astigmatic tests are published, of which the chief forms are a series of concentric circles, and a series of radiating lines (see Fig. 24).

CARE OF THE EYES IN SCHOOL

1. **There must be sufficient light.** Badly lit class-rooms are known to be a cause of myopia. Every class-room should have large windows, the area of the glass being not less than a fifth, or, better, a fourth of the floor space. The windows should not be widely separated from one another. If the lower panes require to be obscured, ribbed glass should be used, and not ground glass, which interferes with the entrance of light. The class-room should not be overshadowed by neighboring buildings, but the sky should be visible from every seat in the room. The position of the windows is important. They should never be in front of the pupils, because this is trying to the eyes. Nor should they be behind, because that is trying for the teacher, and, besides, the pupils sit in their own light, to avoid which they twist round into bad positions when writing or sewing. Lighting from the right avoids these objections, and is suitable for reading, but throws a troublesome shadow of the hand on the paper in writing. Accordingly, *class-rooms should be lighted from the left.* Additional windows to the right are useful for the purpose of ventilation, but must be quite subsidiary to those on the left, so as to avoid cross lights (see also Chapter XIV.).

Artificial light at best is much more fatiguing to the eye than good daylight. As a general rule very little attention is paid to artificial lighting, yet the subject is very important because not only is artificial light often necessary on winter afternoons, but many class-rooms are used for evening classes. In England and Wales over 700,000 pupils enroll for evening classes every year.

Gas is the most generally available illuminant for schools. The objections to it are that it overheats the room and vitiates the air. In class-rooms so lighted the air often seems absolutely stifling to anyone entering from outside.

A class-room in a Board School was till lately lighted by sixteen naked gas-lights, scarcely above the level of the eyes of the pupils in the back of the raised gallery. As the light of an ordinary fish-tail burner vitiates the air as much as five persons, lighting these jets was equivalent to introducing eighty more people than the room was intended to accommodate, while the position of the lights was very trying to the eyes of some of the pupils.

The objections to gas lighting can be greatly reduced by the use of incandescent burners, which consume much less gas. The class-room just mentioned could have been sufficiently lighted with five burners instead of sixteen. Upright burners are preferable to the inverted form, because the gas is more perfectly consumed. Very satisfactory lighting can be obtained with these burners, provided proper shades are used (see below). The lights should not be grouped in clusters, but should be distributed over the desks, each slightly to the left of the nearest pupil.

Electric light has advantages over gas, as it causes no vitiation of the air, saves the trouble involved in attending to incandescent mantles, and can be turned on very readily when wanted for a short time. It costs rather more than gas, but from the hygienic point of view it is quite worth the extra cost. The best, but most expensive, form of electric lighting is the indirect method, which consists in throwing the light of very powerful concealed lamps upon the ceiling, from which it is reflected upon the room below. Very good lighting, however, can be obtained more economically by using the modern filament lamps properly distributed and shaded. A common fault in the installation of such lamps is to connect them in such a way that the lights over the desks farthest from the windows cannot be turned on without turning on all the other lights also, though the latter may not be required.

Shades.—Shades are used for three reasons: (1) Ornament; (2) protection to eyesight; (3) improvement of lighting. The two latter are of paramount importance in the school-room, yet they are little regarded. Few people seem to realize that by the use of good shades it is possible to obtain better lighting at a lower cost.

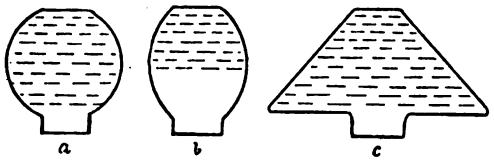


FIG. 27. Gas shades. *a*, Opal, diminishes light. *b*, Half-opal, does not protect eyes. *c*, the 45° shade, protects eyes and improves illumination.

Varieties of Shades.—Shades may be opaque, translucent, or refracting.

(1) *Opaque Shades* should be used whenever, for any reason, a light is hung low. They may be used, for example, for reflecting a bright light onto the blackboard, the illumination of which ought to be particularly good.

FIG. 28. Holophane shade. To show distribution of light.

(2) *Translucent Shades* are much used in the form of opal globes. Most of those in use are very faulty. A good shade ought to—(*a*) protect the eyes completely from the source of light, and (*b*) throw the light where it is wanted. In Fig. 27, *a* completely covers the source of light, but much of the light is wasted, being reflected back instead of passing into the room; *b*, which is opal above and clear glass below, fails to cover the flame; *c* is the 90° shade which is recommended by Mr. Harman. When this shade is used with an upright incandescent gas-burner, it not only completely covers the flame, but it reflects the light down-

ward in such a way that no shadow of the burner is thrown on the desk. An excellent light is thus obtained at a very low cost.

(3) *Refracting Shades.*—The shades known as ***holophane*** are ridged on the outer surface. The ridges are in reality scientifically moulded prisms so formed that the rays of light passing through them are refracted or bent down-

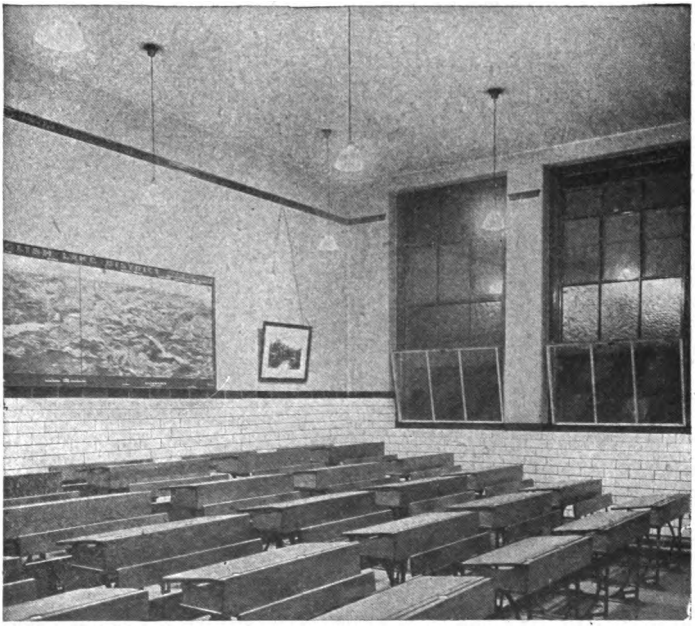


FIG. 29. Class-room. (Holophane illumination.)

wards. In this way the illumination below is greatly improved. A holophane globe can be so constructed that when it is placed over a light 20 per cent. of the rays will pass up, 10 per cent. horizontally, and 70 per cent. downwards (Fig. 28). These globes can be used with either electric light or gas. They have a pleasing appearance,

and are remarkably free from glare. They must not be confused with ordinary prismatic shades, which are ridged or moulded simply for ornament. Figs. 29 and 30 show class-rooms lighted by the holophane method.

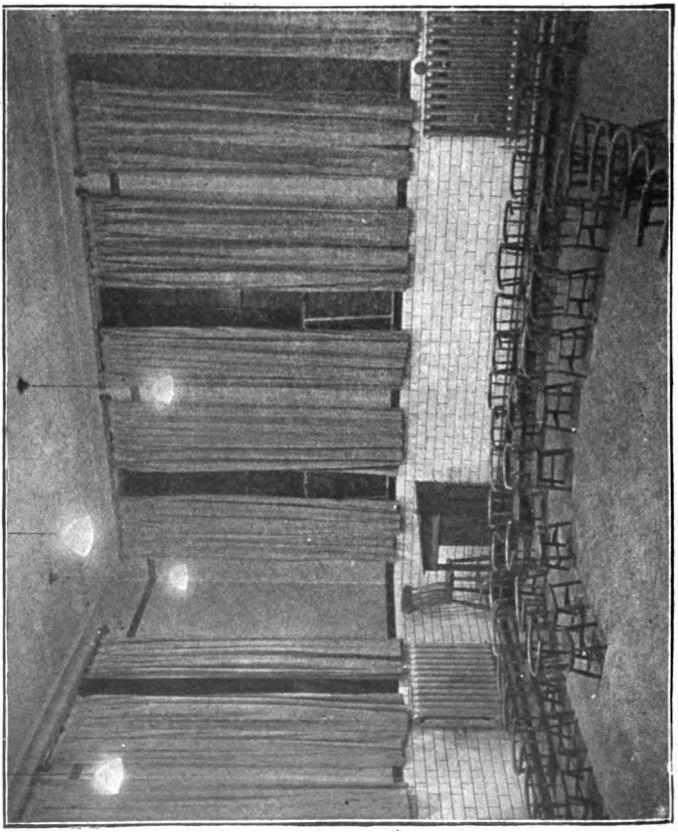


FIG. 30. The infants' hall. (Photographed by artificial light.)

Tests of Lighting.—The light of a class-room can be tested by means of some form of photometer—*e.g.*, Harman's. A rough test is that "brilliant" type should be

easily read 12 inches from the eye in the worst lighted part of the room. It must be remembered that the lighting of a class-room varies greatly according to the time of day. At 9 a.m. it will be 33 per cent. less than at midday. Artificial lighting should give a light equal to *at least* 2-foot candles on the desks as measured by a photometer.

To improve a badly lighted class-room reflectors may be placed outside the window, the walls of the class-room painted white, or almost white, and a white cover provided for the blackboard when not in use.

2. **There must be no glare.** The eyes must be protected from the glare of the sun, or of artificial light, or of bright reflections. The blinds should be of light-colored material, preferably very pale green, and it is an advantage to have the blinds rolling up from below, as often only the lower part of the window requires to be shaded. Another plan is to have casement curtains instead of blinds. They also can be arranged so as to shade the lower part of the window only, and have the advantage of being easily washed. Bright surfaces which might cause injurious reflections should be avoided. Flat paint should be used, and the best color for the walls is a pale green, which is restful to the eyes.

3. **Avoid excessive near work.** As the normal eye at rest is naturally adapted for distant vision, near work necessarily involves effort. The younger the children are, the less fit are they for sustained effort of this kind. Hence in infant schools near work must be minimized, and fine work must be not allowed at all. Some of the kindergarten occupations—*e.g.*, pricking, are dangerous to sight, and there ought to be a law against "needle drill." At all ages work should not be nearer to the eye than 12 inches.

Young children have a very strong tendency to hold books, etc., much too near their eyes, even though they can see quite well at a proper distance. This tendency is well seen in Fig. 31. The children are not posing, the photograph having been taken simply to show an open-air class.

For distant work the blackboard should be dead black,

FIG. 31. An out-door class. Note the tendency of young children to hold their books too near their eyes.

not grey, and should be kept in good order. White chalk is more readily visible than colored, and therefore colored chalks should not be used too freely. Maps and charts should be boldly printed and should not be too glossy.

4. **School Books must not strain the eyes.** Children under six should not be taught to read from books but from

large letters on charts or cards. In choosing school books, teachers should pay attention to the size and clearness of the type. A report recently (1913) issued by the British Association on the influence of school books on sight recommends that type should conform to the following requirements for the ages given:*

Age of Reader.	Minimum Height of Small Letters.	Minimum Interlinear Space.	Maximum Length of Line.	
Years.	Millimetres.	Millimetres.	Millimetres.	Inches.
Under 7	3.5	6.5	—	
7 to 8	2.5	4.0	100 or	4
8 to 9	2	2.9	93 or	$3\frac{3}{4}$
9 to 12	1.8	2.4	93 or	$3\frac{3}{4}$
Over 12	1.58 ($\frac{1}{16}$ in.)	2.2	93 or	$3\frac{3}{4}$

The length of the line is important. The shorter the line the more frequently the eye has to move from side to side. The longer the line the farther the eye has to move, and the greater the difficulty in passing from one line to the next. Hence it is fatiguing to have the lines either too short or too long. The best length is about $3\frac{1}{2}$ inches. Too little space between the lines is also a source of fatigue. Good margins are restful to the eye.

The type should be clear, with the blacks and whites well balanced in each letter, so that it is easy to distinguish between *C* and *G*; between *e*, *c*, and *o*; between *h* and *k;* and between *i* and *l*. The contrast between the finer and heavier strokes of the letters should not be too great, and italics should not be used too freely.

Books should be printed in black ink on strong and smooth, but not glossy, paper. *The colored letters* used in some school readers are to be strongly deprecated. Books should also be bound so as to open flat. Many books are

* Fuller particulars are given in the Report of the British Association, 1913.

wire-stabbed or thread-stabbed, so that they require to be held open. Even so, the pages assume a convex surface which is tiring to the eye.

The Bibles and hymn-books used by children are frequently printed in type which is much too small. But children should not be forced to carry heavy Bibles to school in order to obtain good print, as the books of the Bible can be obtained separately in sufficiently large type.

Special attention should be paid to textbooks on arithmetic, algebra, and mathematics, and to the notes, questions, and examples which form an important part of many school books. All these should be printed in type which conforms to the rules already given. In using "arithmetics" and "algebras," the continual glancing back and forward from book to paper or slate is very fatiguing to the eyes; hence the figures, fractions, and symbols should be very clear.

It is difficult to avoid the use of small type in atlases, but many school atlases are needlessly confusing, and overcrowded with names. The coloring of the maps should be pale, and the names should be very clearly printed. When drawing maps, children should not be allowed to indulge in very minute penmanship, or in fine shading, but should draw their maps of fair size in bold outline, and insert only the principal names. They should not draw maps, or anything else, except by good daylight.

The British Association Committee recommend that *music* for beginners should be of the size of "Giant Note." For others the stave-lines should not be less than 1·75 millimetres apart, or the four spaces should measure not less than 7 millimetres. *German* books for school use should be printed in Roman type. *Greek* type should not have fine hair lines, and the size for reading should not be less than twelve-point for beginners, and eleven-point for experienced readers.

SPECIMENS OF TYPE

UNDER SEVEN

This type may be read by children under seven

AGE SEVEN TO EIGHT

This type is suitable for children of seven to eight

AGE EIGHT TO NINE

This type is suitable for books for children from eight to nine years old

AGE NINE TO TWELVE

This type is suitable in size for books to be read by children over nine years of age

OVER TWELVE

This type is suitable in size for books intended for practised readers over twelve years of age

5. **Writing must be done in a good light with black ink on white paper.** Writing as a form of physical training has already been discussed. As a means of expression writing is best done on paper, because a better contrast is afforded than by slates, which are gradually being discarded for hygienic reasons. The pen is preferable to the pencil in that, if a good ink is used, the contrast is more marked; but, on the other hand, its manipulation requires greater skill. Inks which write black are to be preferred to those which only turn black with time.

6. **Sewing is a great offender** in respect to the production of eye-strain. The samplers worked by our grandmothers, the usual age for the completion of which was ten years, must have caused many weary eyes.

The *old method of teaching sewing* begins with an absurd and mischievous procedure called "needle drill," followed by practice in fine stitching on bits of cloth. This method causes eye-strain; work is sure to be held too near the eyes, and the child soon becomes weary and inattentive owing to the uninteresting character of the work.

The *new method* consists in making real articles of loosely woven material, beginning with darning needles and worsted and large stitches. Colored threads and light (cream) cloth should be used. Even this should not be begun before seven or eight years of age. This method interests the children from the first, attention is easily maintained, and the movements are such as they can readily practise without strain. The opportunity afforded for artistic training should not be neglected.

As in the case of writing, sewing can be prepared for by hand-work which requires less fine adjustments of movement—*e.g.*, paper folding, cane-weaving, spool-knitting, etc. Some children should not have sewing lessons at all without medical sanction. This applies not only to children with defective eyesight, but to many delicate and

nervous children. Throughout the lesson, which should be short, the teacher should see that the children maintain a good position and do not bring the work too near the eyes.

Summary as to School Work

1. In all lessons involving near or fine work (reading, writing, drawing, sewing), the teacher must take care to see that a proper working distance is maintained.

2. No fine work must be done except in a really good light.

3. Fine work must not be begun too young.

4. Lessons involving fine work must be short—the younger the children, the shorter the lesson.

CHAPTER X

THE EAR, NOSE, AND THROAT

THE ear, throat, and nose are closely related in their hygiene. The passage for the air and the passage for the food cross each other in the pharynx, and as nearly all the infections to which child-flesh is heir are conveyed either by air or food, it is not surprising to find that the pharynx is particularly vulnerable. At any rate, this is the case, and especially amongst those children whose general vitality has been lowered by lack of fresh air at home or at school.

Adenoids.—Amongst the local affections of this region the most common is that known as adenoids. Professor Holt says that these are "the source of more discomfort and the origin of more minor ailments than almost any other pathological condition of childhood." Adenoids are little swellings composed of lymphoid tissue—the same kind of tissue as the tonsils—which grow in the naso-pharynx, and block it up partially or completely. The cause of the condition is not known, but adenoids are most common in changeable climates, and their presence is associated with frequent cold-catching.

Sometimes the *symptoms* may start in infancy, but they are usually most marked in children of six to eight. The principal symptoms are mouth-breathing, a flat and nasal voice, slight deafness, mental dulness, malnutrition, and deformities of the chest. Children with adenoids often have a stolid stupid expression, narrow nostrils, and a

gaping mouth. They have a curious resemblance to one another. The little boys in the illustration (Fig. 32) might be brothers, but in reality they are not related. The deformity of the chest is due to the obstruction to the entrance of air, which prevents proper expansion of the chest. The difficulty in breathing is most marked during the night, and may interfere with the child's sleep.

Adenoids are very important from the educational point of view, partly because they are so common; partly because,

FIG. 32. The adenoid expression. (From Elder and Fowler's *Diseases of Children*.)

in addition to their interference with the child's general health, they often produce a remarkable degree of mental dulness, so much so that severe cases may be supposed to be mentally defective. This dulness is partly due to the deafness, but it is also largely due to lack of oxygen resulting from the obstructed respiration, and to loss of sleep.

Very slight cases of adenoids may recover spontaneously, but if the symptoms are at all marked, the adenoids should be removed by an operation. The operation required is a very slight one, and the improvement which takes place afterwards is often very remarkable, a listless, inattentive child becoming alert and active, and making more progress in school studies in a few months than had been made perhaps in as many years.

Enlarged Tonsils.—The tonsils are liable to *acute* inflammation in quinsy, and in some infectious diseases such as scarlet fever.

Chronic enlargement is very common in school-children, and is very frequently associated with adenoids. Fifty-two per cent. of the children Dr. Mackenzie examined in the Canongate School had enlarged tonsils or adenoids, or both. Enlarged tonsils are often associated with, and perhaps caused by, decayed teeth.

Very large tonsils may interfere with respiration and possibly give rise to deafness. They are also a source of danger to the child because they make him liable to acute attacks of tonsillitis, and increase the risk of contracting diphtheria, tuberculosis, and other germ diseases. They should therefore in all cases receive suitable treatment by astringent applications in recent cases and by operation in chronic cases.

Nasal Obstruction may arise from other causes besides adenoids.

The chief cause of acute obstruction is cold in the head, the symptoms of which are only too familiar. Although colds are commonly attributed to cold, or to sitting in a draught, there can be no doubt that they also arise from infection very frequently. A chill probably acts chiefly as a predisposing cause by lowering the power of resistance. Chill and infection together may result in a cold when neither separately would have done so.

The best preservative against cold is pure fresh air. People who are out in the open the greater part of the day seldom catch cold. Children should be accustomed to be out of doors a great deal. When indoors the room should be kept fresh and well ventilated. Class rooms should not be occupied continuously hour after hour, but between lessons the children should be sent out and the room thoroughly flushed with air. Sudden changes of temperature are dangerous, and in very cold weather it is a good plan to make the children have a little active exercise to quicken the circulation before sending them out into the cold.

Chronic obstruction of the nose may be due to thickening of the mucous membrane the result of repeated colds, to deformities, or to little growths called polypi. These conditions need not be further referred to. Obstruction by a *foreign body*, however, is likely to come under the notice of a teacher of young children. The child pushes some small object into the nose and cannot get it out. Perhaps he says nothing about it. Irritation is set up, and in a few days a thick mattery discharge from the nostrils appears. Such a discharge from one nostril is always suspicious of a foreign body. The best thing to do in such a case is to make the child take a long breath through the mouth, and then blow his nose hard. If the object cannot be expelled in that way, the child should be taken to a doctor. Efforts to remove the object by such an implement as a hairpin are only likely to push it farther in.

THE EAR

It is fairly well known that some degree of deafness is very common among children—so common, indeed, that any ordinary class is likely to contain several children whose hearing is imperfect in one or both ears. It is not so well known as it should be that even a slight degree of

deafness is a very serious educational handicap. A child who is slightly deaf loses in two ways. He loses a great deal of the incidental instruction which the sharp-eared child picks up without effort. His knowledge of language is therefore retarded. And, secondly, he is likely to be inattentive in class, and to hear imperfectly or to misunderstand what is said by the teacher. "Bad spellers" and the child who "can attend when he likes" are often found to be slightly deaf. The inattention is due to the fact that these children have to make a much greater effort to attend than normal children, and therefore tire more quickly.

The Causes of Deafness—1. *Outer Ear Deafness.*—One of the most common causes of deafness is the blocking of the outer passage of the ear by *wax*. Very often the plug of wax is deeply seated, so that it can only be seen when examined by the doctor with a speculum. The treatment of the condition consists in syringing the ear with warm water, after the wax has been softened by dropping a little oil into the ear for a few nights previously.

Sometimes, as in the case of the nose, a small child may introduce a *foreign body* into the ear. When this happens, no alarm need be felt, and no effort should be made to remove the body with any instrument. Such an attempt might very easily result in damage to the drum of the ear. The proper treatment is to remove the body by syringing the ear with warm water.

2. *Middle Ear Deafness.*—This is the form of deafness which occurs in children who suffer from adenoids or from running ears. The middle ear, which is the little space just within the drum membrane, is connected with the naso-pharynx by a passage called the Eustachian tube. This passage serves as a ventilating shaft for the middle ear. In case of adenoids or nasal obstruction its function is interfered with, and deafness results. Moreover, infection

may pass up the tube, and set up catarrh in the middle ear. This may become chronic, and cause deafness. Sometimes the infection is of an acute nature, and results in the formation of what is practically a little abscess in the middle ear. This causes severe ear-ache. Presently the drum membrane ruptures, pain is relieved, and there appears a discharge from the ear. This discharge may soon stop and the rupture may heal up, leaving little or no impairment of hearing, but often the discharge persists for a long time. It may become copious and extremely offensive.

A *discharging ear* should never be neglected. Apart from the resulting deafness, there are other attendant dangers of so serious a nature that insurance companies will not accept a candidate who has a discharging ear. For example, inflammation may spread inwards and set up inflammation in the membranes of the brain (meningitis), or an abscess in the brain itself—conditions nearly always fatal.

Another serious, but fortunately rare, result may be referred to, because it may come under the notice of the teacher in class. This is the formation of a *mastoid abscess* —an abscess in the bone behind the ear. A child who has suffered from a discharging ear comes to school some day with one ear projecting from the side of his head. The skin over the bone behind the ear is slightly swollen and tender. Perhaps the child feels a little sick. Perhaps he makes no complaint. Anyhow, he is not thought to have much the matter with him. Yet if a mastoid abscess is forming, the matter is a very serious one indeed, and the delay of a few hours in the performance of a surgical operation may allow fatal complications to set in. Accordingly, every child who is even suspected to be suffering from such a condition should be examined by a surgeon at once, and the teacher should consider it his duty in such cases

to explain the matter to the child's mother, whc is not likely to be aware of the danger.

3. *Inner Ear Deafness.*—Deafness due to an affection of the inner ear is often congenital and complete. Children so affected are deaf-mutes. The reason the deaf-mute does not speak is not because there is anything wrong with the organs of articulation, but simply because, being unable to hear, he does not acquire speech. Such children are often very observant, and very quick to interpret the gestures of those about them. Consequently it often occurs that they are not supposed to be deaf, and medical advice is generally sought because they do not learn to speak.

TESTS FOR HEARING

1. *Class Work.*—In ordinary class work the teacher has abundant opportunities for forming an opinion as to which children in the class are hard of hearing. Children who are inattentive or who are particularly bad spellers should always be suspected of being hard of hearing. So, also, should children who are suffering, or are known to have suffered, from a discharging ear. A good test is to give a piece of dictation in a low voice. The hearing of the children who do badly can then be tested more carefully.

2. *The Whispered Voice.*—A more definite but convenient test may be carried out as follows: A quiet room should be selected, and a line on the floor marked out in feet. The child stands at one end of the line, with the ear to be tested directed towards the teacher, who stands at the other end. A folded towel should be held firmly over the child's other ear. The teacher should then draw a breath, and ask the child some question in as loud a whisper as possible. If the child does not hear, the teacher should come nearer and nearer, repeating the question until he finds at what distance the question can be heard. Several

normal children must be tested also in order to find out at what distance the voice ought to be heard. A useful method of noting the condition of the child's hearing is to make a fraction of which the numerator is the distance at which the child tested can hear the whisper, and the denominator the distance at which a normal child can do so. For example, if a normal child can hear the whisper at 20 feet and the child tested can only hear at 3 feet, with his left ear, we would note the hearing L. $=\frac{3}{20}$. The important points to attend to in this test are that the room must be perfectly quiet; the whisper should always be as loud as possible, thereby securing uniformity; the ear not being tested must be closed; and the child must not see the face of the examiner in case he may read the movements of the lips. Questions which might be guessed, such as "What is your name?" should be avoided.

3. *The Watch Test.*—This test consists in finding out at what distance the tick of a watch can be heard by the ear tested. A stop-watch may be used, but an ordinary watch with a loud tick will do very well. The child should be blindfolded, and the watch held for a moment close to his ear, so that he may know what to listen for. It should then be moved back and forward until the greatest distance is found at which it can certainly be heard. As children often say they hear the tick when they really do not, this test is open to fallacy, and for a teacher's purpose the whispered voice test is preferable.

The Hygiene of Hearing.—By far the most common cause of deafness is some affection of the middle ear, and the hygiene of the middle ear is the hygiene of the throat and nose, and of respiration. The hygiene of the middle ear requires that any source of obstruction of the Eustachian tube, such as adenoids, or of infection such as decayed teeth or diseased tonsils, should be removed or cured, and

that children should habitually breathe pure air by the nose.

Hygiene of the Ear.—With regard to the ear itself, cleanliness is of the first importance. Children are very apt to neglect to wash their ears properly, and consequently the auricle or outer ear is very liable to skin eruptions such as impetigo or eczema. On the other hand, too great attention to cleanliness sometimes takes the form of pushing the end of a towel into the ear passage with the idea of removing wax. Unfortunately, this practice may result simply in pushing in the wax, which, if left alone, would have dried up and fallen out. In this way the passage may become blocked completely.

The educational treatment of deaf children is referred to in Chapter XI.

CHAPTER XI

VOICE AND SPEECH

Voice is produced in the larynx by vibrations of the vocal cords. The pitch of the voice depends upon (1) the *length* of the vocal cords, and (2) their *tension*. A man's voice is deeper than a woman's because the vocal cords are longer. A boy's voice breaks down between the age of twelve and fifteen because, during this period of rapid growth, the vocal cords double in length. The *tension* of the cords is altered by contractions of the muscles of the larynx, and thus changes in pitch can be brought about within the limits determined by the length of the cords. The range of the human voice is about three and a half octaves; of individual voices, about two octaves.

The different vowel sounds—*ah*, *ay*, *ēe*, *o*, *ōo*—are produced by modifications of the original sounds produced in the larynx, by alterations in the form and capacity of the oro-nasal cavities. The vowel *i* (as in "nigh") is obviously a diphthong—*ah-ēe*; *u* (as in "due") is *ēe-ōo*.

Consonants are formed by interruption of the current of air somewhere above the larynx. Some consonants are voiced (B, V, D, etc.); some are voiceless (P, F, T, etc.); some have a nasal resonance as well as voice (M, N, Ng). In whispering there is no voice, but the characteristic overtones of the oro-nasal cavities, shaped for the production of each sound, are excited by the vibrations of air under strong friction.

Professor Wyllie's physiological alphabet shows how the

consonants may be classified according to their mode of production, and a careful study of it will enable the teacher to demonstrate how faults in articulation may be corrected.

THE PHYSIOLOGICAL ALPHABET.

	Voiceless Oral Consonants.	Voiced Oral Consonants.	Nasal Resonants.
Labials	P	B	M
		W	
Labio-Dentals	F	V	
Linguo-Dentals	Th (as in "thin")	Th (as in "this")	
	S	Z	
Anterio Linguo-Palatals	Sh	Zh	
	T	D	N
		L R	
Posterior Linguo-Palatals	K	G (hard)	Ng
	Ch	Y	
Aspirates	H		

It would be a useful exercise upon this table to prepare sentences (which might be used for practice in suitable cases) composed of the various groups of letters—*e.g.*, labials— P, B, W, M. "Poor Brown went mad."

Breathing for Voice.—The proper management of the voice involves the control of the breath. This may be aided by deep-breathing exercises which should increase the mobility as well as the capacity of the chest. On the other hand, forced breathing, such as may be associated with severe muscular exertion, may lead to stiffness and rigidity of the chest walls. Singing provides the opportunity for the best kind of breathing exercises for voice production. In singing it is necessary to breathe deeply, and the most advantageous method is to inspire by expanding the lower part of the chest. During inspiration the abdominal wall is kept still; but when the chest is expanded, the air required to produce the voice is driven out by the

contraction of the abdominal muscles, which, of course, must be relaxed again at the beginning of the next inspiration. This method of breathing economizes the breath and diminishes strain upon the vocal cords. It should therefore be learned and practised by all who have to use their voice a great deal.

When children are reading aloud, attention should be paid to their breathing as well as to their articulation. This involves paying attention to their attitude, the pace at which they read, their pauses, their modulation of the voice. Too often one hears children reading in a monotonous voice, paying little attention to the pauses, and perhaps running themselves completely out of breath. These are bad faults which should be corrected, perhaps by definite instruction and drill directed to the end desired. But there is a better, and perhaps in the long-run a quicker way. Children learn much more readily by imitation than by deliberate effort. All children, therefore, should hear a great deal of good reading with plenty of dramatic expression, and the opportunity for imitation should be provided for by acting, the educational value of which has been lost sight of in a most extraordinary way. A well-chosen play acted in the open air might easily combine voice-production, physical exercise, and practical hygiene with history, geography, and English literature.

SPEECH

Speech is well known to be dependent upon the activity of certain areas in the brain. The chief speech centre is in the third frontal convolution on the left side of the brain, and is commonly called "Broca's area," after its discoverer. If this area is injured, the patient may recover consciousness, but he will be unable to speak, though he may understand all that is said to him. The area immediately above

Broca's convolution is called the "writing centre," because if it is injured the patient cannot write spontaneously, though he may be able to write from a copy.

These two centres are concerned with the expression of

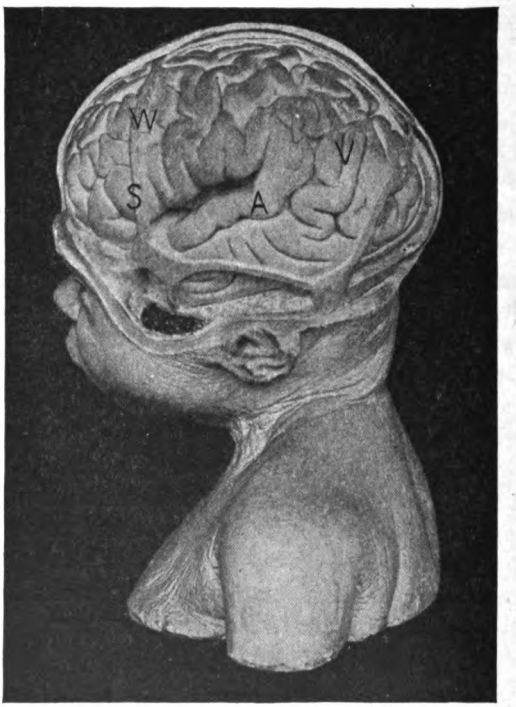


FIG. 33. Child's brain, showing language centres. *S*, Speech; *W*, writing; *V*, visual (word-seeing); *A*, auditory (word-hearing) centres.

thought. Two other centres are concerned with its reception. These are the word-hearing and the word-seeing centres. If the former is injured, the patient may be able to see, but he cannot read; if the latter, he may hear, but he cannot understand what he hears. These two centres

are specialized parts of the centres for sight and hearing respectively. All the centres named are associated with one another, and with higher centres still, concerned with mental processes.

The child learns to speak by imitation. At birth the convolutions in which the language centres afterwards develop are all present, but the development of the centres themselves depends upon use. The infant listens to sounds, and gradually learns to reproduce words heard, and to attach a meaning to them. As happened in the history of the human race, speech follows the natural language of gesture and sign, and precedes drawing and writing. In a deaf child the hearing centre cannot develop, and consequently the deaf child has no language save gesture. The chief difficulty in teaching a deaf-mute does not reside in the fact that he cannot hear, but in the fact that he is without language. The normal child who is learning to read knows the words already. All he has to do is to learn to recognize the symbols. But the deaf-mute does not know a single word. Every word has to be taught him separately, and there are no words to teach them with. At seven or eight years of age his mental development, so far as language is concerned, is behind that of a child of two. In this respect the deaf child is worse off than one who is blind. The blind child acquires speech just as the normal child does. He can listen to conversation, and ask whatever questions he pleases. It is therefore comparatively easy to educate him, but the task of educating the deaf-mute to the stage of possessing and being able to use a language is extremely difficult—so difficult that a large proportion of deaf-mutes, in spite of painstaking instruction, never acquire sufficient knowledge of words to be able to read a book for pleasure. A little consideration of what deafness means with regard to the mental development of the deaf-mute will make clear

the fact that even a moderate degree of deafness in a young child must have a retarding effect upon mental development. A considerable proportion of the children who are commonly called dull, stupid, or backward, are really hard of hearing. It is therefore of great importance that teachers should be able and willing to test the hearing of their pupils. It does not take very long to test a whole class, and it is just as much the province of the teacher to test hearing as it is of the workman to test the sharpness of his tools.

The medical and surgical treatment of deafness is referred to in Chapter X. The educational treatment of deaf children is equally important. Dr. Kerr Love divides children whose hearing is defective into the following groups:

1. *Slightly Hard of Hearing.*—These hear the whispered voice at five yards, but not more (normal distance twenty-five yards). These children should be given a front seat in the ordinary class.

2. *Moderately Hard of Hearing.*—These hear at one to three yards, and are often backward owing to their deafness. They will make good progress if taught by ordinary methods in smaller classes.

3. *The Semi-Deaf.*—These can hear a loud whisper at one yard, but not more. They require training in articulation and lip-reading by a specially trained teacher. They should not mix with the deaf and dumb, but should be taught in small classes in a day-school.

4. *The Semi-Mute.*—These are children who have lost their hearing at five, six, or seven years. They are liable to lose their speech unless it is specially exercised. They should be taught along with the semi-deaf, and not with the deaf and dumb.

THE DEFECTS OF SPEECH

The principal defects may be classified as follows:

1. Due to mechanical causes—hare-lip and cleft palate; adenoids, and enlarged tonsils; nasal obstruction; defective teeth.

2. Functional defects—lisping, lalling, stammering, and stuttering.

3. Due to deafness—deaf-mutism.

4. Due to defective brain development—imbecility, word-deafness.

Hare-Lip and Cleft Palate are congenital defects which may occur singly or together. A hare-lip is usually closed in early infancy by a surgical operation. The operation for cleft palate is usually performed later, because it is more serious. It should, however, be done before the child learns to speak. The speech is usually markedly affected in these cases, and it is by no means certain that an operation done after the child has learned to talk will produce much improvement in speech.

Faulty Articulation.—As children learn to speak by imitation, faulty articulation is least common among children who constantly hear their native language well spoken. Faulty articulation may be due to deafness, or to mechanical defects, or to an impetuous tendency to express thoughts without taking the trouble to form the words clearly. Most cases, however, are due to bad example and the want of proper training at home or at school. It is, no doubt, difficult for a teacher, when classes are large, to pay special attention to the correction of individual faults of articulation, but it ought to be done. Slovenly and defective speech may be a great handicap to a child in later life, as it naturally tends to convey a poor impression of his educational attainments.

Lisping usually takes the form of replacing "s" by "th." It is very common in children learning to talk. If it persists too long, it is not generally difficult for the child to learn to pronounce properly if he is shown how the correct sounds are made.

Lalling is the name given to the persistence of baby speech in a more pronounced form than in simple lisping. It is very common in feeble-minded children, but it does not necessarily imply any want of intelligence.

Idioglossia is the name given to a form of speech so unintelligible as to give the impression that the speaker has a language of his own. In reality the child's speech is badly pronounced English, but there is often little or no connection between the sounds uttered and ordinary English words. The causation of the condition is obscure. The children affected may be perfectly intelligent, and their hearing may be perfect. Probably the fault is in the word-hearing centre in the brain.

Training may effect a rapid improvement in this condition. A case at present under observation is a boy of thirteen whose speech till recently was quite unintelligible to any one but his own relations. Many of the consonants he missed out altogether. The nearest he could attain to saying "the school" was "ud kooi," and the rest of his speech was just as far from the mark. As he was quite intelligent and anxious to speak like other people, he was shown how to pronounce the different sounds, and alliterative sentences were given to him to practise at home daily. Within three months he was able to speak quite clearly and intelligibly, though rather monotonously, his speech being a little like that of an unpractised reader. Indeed, the boy is a good visualizer, and when asked to say a difficult word, he seems to "see" the word before him. On the other hand, he has little or no musical ear.

Stammering is perhaps the most important defect of speech, owing to the frequency of its occurrence and the distress it gives to the sufferers. A distinction is usually made between stammering proper and stuttering. Stammering consists in a spasmodic arrest of utterance, usually at one of the physiological stop positions—that is to say, at the lips in the case of B, P, M; at the teeth in the case of T, D, Th; and farther back, between the tongue and the palate, in the case of K, G (hard), S, Z, Sh, Zh, Y.

The explosive consonants (T, D, P, B, etc.) are those which most frequently give rise to difficulty.

Stuttering consists in the spasmodic repetition of syllables, Thus, the stutterer produces the consonant at the beginning of a word perfectly well, but instead of throwing his voice into the vowel which follows, he repeats the initial sound a number of times till suddenly the rest of the word or the whole sentence comes with a rush. There is, however, no essential difference between stammering and stuttering. In both cases there is a failure to coördinate the voice (produced in the larynx) with articulation.

Causes of Stammering.—Stammering can sometimes be traced quite definitely to a fright; it is frequently attributed to imitation; it is often said to have "come of itself." Predisposition is certainly important, for the affection occurs most frequently in nervous children, and it is five times as common in boys as in girls. The defect varies with the general health, and a sharp illness may cause the recurrence of a stammer which had ceased.

The Treatment of Stammering.—The general health of the stammerer, and any local source of irritation, should be attended to, but the treatment of stammering is essentially educational. As breathing is frequently very much at fault, breathing exercises are very valuable, and these may be advantageously combined with singing. Stammerers can usually sing without stammering. This is due

to the fact that in singing the attention is directed to the production of the voice, while articulation becomes almost subconscious, and thus the excessive effort which causes the stammer in speaking is avoided. For the same reason many stammerers can read aloud, especially if some one reads along with them. Breathing exercises, singing, and reading aloud should therefore be practised diligently for a definite time every day.

The special defects of each individual case must be studied, and instruction given in the methods of overcoming them. The stammerer must be taught how to control his breath, how the consonants which give him difficulty are formed, and how to direct his attention to the vocalization of the vowels. Above all, he must be encouraged to believe that his difficulty is one which can be overcome. All who treat stammerers know the value of confidence and hope. Many who stammer in public do not stammer in their own homes, where their confidence is greater. Possibly this brings us nearer to an understanding of the essential nature of stammering.

A large proportion of stammerers can be cured by such treatment as has been detailed, but some cases are very intractable, and it is held by some* that in such cases a process of mental analysis, carried out by special methods, may assist the sufferer to overcome his disability.

Congenital Word Blindness.—This very interesting condition is comparatively rare. Dr. Thomas calculates that about one child in a thousand is affected. The peculiarity of the condition is that a child who is perfectly intelligent yet cannot learn to read. Curiously enough, it is often a long time before the teacher suspects that anything is wrong. The child may have a very good memory, and, if he is coached in his lesson at home, he will stand up in class,

* See *Stammering and its Cure*, by Alfred Appelt.

when it is his turn to read, and acquit himself quite satisfactorily. In reality he simply repeats from memory what he seems to read. He may know the names of the letters, but in his mind there is no connection between letters and sounds or words. In an Edinburgh school the writer heard a boy affected in this way "read" a portion from his lesson book quite correctly. He then pointed to a word in the passage "read," and asked what it was. The boy did not know. Told to spell it, he did so correctly—y-a-r-d. "Well, what is that?" "Glasgow," he replied. The word "Glasgow" was actually in the sentence. This boy was nine years of age, and was rather above the average in all his lessons except reading; yet so far was he from appreciating the meaning of letters that, so far as he could see, y-a-r-d was just as likely to spell Glasgow as anything else. With figures, however, he had no difficulty, and was very good at arithmetic.

What very often attracts the teacher's attention in cases like this is that the child cannot read words on the blackboard. Naturally, this is supposed to be due to some defect of sight, and a number of the earlier cases were actually discovered by ophthalmic surgeons to whom the children had been sent to have their eyes tested.

Nature of the Condition.—This condition is probably due to the failure of the word-seeing centre to develop. Although the child can see quite well, he is unable to store up memories of printed words, and consequently he cannot learn to read, because he fails to recognize the words he sees, no matter how often he has seen them before. Sometimes the child can learn the letters, and then, if he spells a word aloud, he may recognize it from the sound. It is doubtful to what extent these cases can improve. Some are probably incurable, but some will make progress slowly if short private reading lessons are given to them.

There is an analogous affection, called *congenital word deafness*, in which the word-hearing centre in the brain remains undeveloped. In such cases the child can hear quite well, but he cannot remember the sound of words. Consequently he does not learn to speak. For obvious reasons such a child is not likely to be found in an ordinary school.

CHAPTER XII

THE SKIN

THE skin has many functions. It is a protective covering, and the underlying fat assists in protecting delicate structures from undue pressure. It regulates the temperature of the body. It is an organ for the sensations of touch, pain, heat, and cold. It excretes sweat and sebaceous matter.

In children the skin is more extensive relatively to their size than in the adult. For this reason children are readily susceptible to chill, in spite of the activity of their heat-forming processes. The skin of children is also more delicate, and much more susceptible to certain diseases.

Hygiene of the Skin.—The skin should be kept clean. Children should have a bath every day. For young children the bath must be warm, but children should be accustomed early to cold water, owing to its invigorating qualities. A cold sponge or plunge every morning, followed by brisk rubbing, is extremely beneficial to children subject to colds, but time should not be wasted over the process. If the child feels cold and shivery after the bath, or appears blue instead of experiencing a warm glow, harm has been done instead of good. Soap is not necessary for this tonic plunge, but for cleansing purposes soap must be used, and warm water is preferable to cold. The teacher can give no more practical lesson in hygiene to children than by constantly insisting on clean hands and faces. Lavatories should be convenient of access. The

basins should be such as empty quickly, and should not easily block; or preferably they may be arranged for the children to wash under a flowing tap. The allowance of towels in schools is usually far too scanty. Towels readily carry infection, and children suffering from sore eyes should never be allowed to use the same towels as other children. Paper towels have been introduced, and obviate this danger, as a separate towel is used by each child.

CONTAGIOUS AFFECTIONS OF THE SKIN

The principal animal parasites of the skin are fleas, lice, and acari or itch mites.

Pediculosis is the name given to infection by lice and their eggs, or nits, which are found attached to the hair. The affection results from contagion, but is so closely associated with want of cleanliness that it has been well said that even those who cannot help getting lice can help keeping them. Pediculosis varies greatly in degree. In slight cases where the scalp receives some care, only a few nits may be seen, while in neglected cases the whole scalp may be swarming with vermin. In such cases great irritation is set up, the hair becomes matted, and foul-smelling crusts collect. The glands of the neck become inflamed, and the child's health suffers from the irritation and want of sleep.

The treatment of pediculosis is becoming a question of public importance. The affection is so extremely prevalent in many schools that it is almost impossible for careful mothers to keep their children free from contagion, and many of them give up the struggle. Cleansing schemes have been introduced in a good many towns. The children are inspected at regular intervals, perhaps by a school nurse, and cards are sent to the mothers of children whose heads require attention. The cards contain simple directions for treatment. If the matter is not attended to, the

nurse calls at the house and gives any assistance which may be required. If parents refuse to attend to the matter in spite of repeated warnings, the child can be excluded from school, and the parents prosecuted for not sending the child to school in a fit condition.

In slight cases the parasites and their eggs can be got rid of by several washings with soap and water to which paraffin has been added; or the hair may be thoroughly soaked in oil of sassafras and tied up for the night, and thoroughly washed in the morning. The nits can be removed by combing carefully with a fine tooth-comb *before* the soapy lather is washed out of the hair, or by wetting the hair with vinegar during the process of combing. In badly neglected cases, where the scalp is covered with sores, it is necessary to cut the hair quite short before effective treatment can be applied. It is in such cases that the nurse can be of great assistance. Children so badly affected may be treated at a school clinic. In some cases the home conditions are so bad that satisfactory treatment must include a disinfection of the house and bedding.

Scabies, or itch, is due to a minute parasite which burrows in the skin, and thereby gives rise to intense itching. The parasite is very minute, looking rather like a microscopic tortoise with eight stumpy legs. It has a predilection of the hands and feet, especially for the thin skin between the fingers and toes. In school the condition is most likely to attract attention by an eruption of small pimples on the hands. It can sometimes be noticed that many of these are arranged in pairs, and there are often marks of scratching. The affection is specially contagious when the skin is warm, because then the young parasites emerge from the burrows and perambulate on the surface. It will usually be found on inquiry that other members of the family are affected, especially any who occupy the same bed. The popular treatment consists in a hot bath, fol-

lowed by the application of sulphur ointment well rubbed in. The clothing and bedclothes must also be disinfected, otherwise reinfection is very apt to occur.

FIG. 34. Scabies.

Ringworm is a common affection, and interferes greatly with school attendance. It is due to the growth of a minute fungus allied to mould. It may appear on the face, when it presents the appearance of a ring, but it is usually seen on the scalp, where it takes the form of one or more circular patches. The patches are not bald, but are covered with minute stumps of hair about an eighth of an inch in length. These stumps appear dry, and when

pulled upon are easily extracted without causing pain. The patches are sometimes covered with whitish scales. If left to itself, ringworm gradually spreads over the scalp, and may last for years. The ordinary method of treatment till recently consisted in the application of ointments.

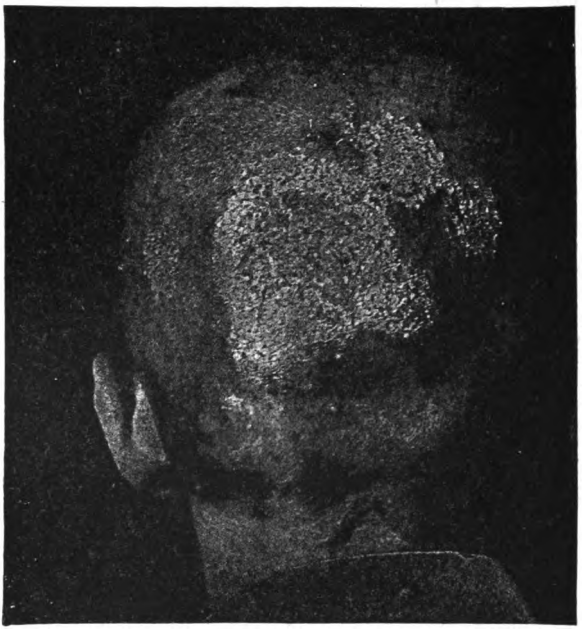


FIG. 35. Ringworm. (From *Skin Affections in Childhood*, by Dr. H. G. Adamson.)

A scurfy patch (*not a ring*) with stumps of broken hairs.

This treatment was not satisfactory except in very early cases, the reason being that the hairs are infected to their very roots. Consequently medicaments applied to the surface fail to effect a thorough destruction of the fungus. Commonly a child was taken to hospital and treated for a few weeks or months, and then ceased to attend because

the disease was supposed to be cured. After treatment had been neglected for a few weeks, however, the condition was as bad as ever, with the result that the child lost, perhaps, years of schooling. A much more efficacious

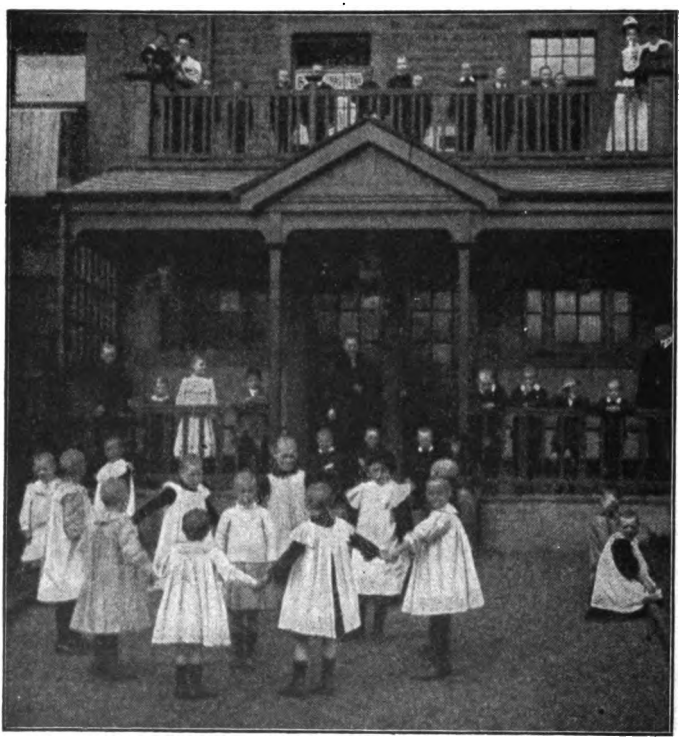


FIG. 36. School for skin cases.

treatment, and one which is now in general use, is the application of the X rays. Exposure to the X rays loosens the hairs, which after a week or two can readily be removed, allowing ointments to be successfully applied. Under this method of treatment cure is comparatively

rapid even in the worst cases. The average time required for a cure is less than four months. In some towns skin schools have been opened, where children suffering from this and similar affections can attend for education and treatment.

Alopecia is a much less common condition, which must be mentioned because it is often mistaken for ringworm. It consists of round patches on the scalp which, unlike ringworm, are really bald, the hairs having fallen out. Possibly this condition is slightly contagious, but it is not usual to exclude affected children from school.

Favus resembles ringworm in that it is due to a mould fungus. In most places it is an extremely rare disease, but it is fairly common amongst Polish Jews in London. It is also not very uncommon in Edinburgh. The scalp of children affected is covered with little yellowish crusts, which sometimes have a honeycomb appearance and a strong mousy odour. It is even more intractable than ringworm, and was till recently considered practically incurable. However, it has been found amenable to treatment by the X rays, and some favus schools which were opened for the special treatment of the disease have been closed because all the cases were cured.

Impetigo is a contagious affection due to the invasion of the skin by certain microbes. This is the condition which so frequently causes the skin or scalp of children to "break out." It is often erroneously termed "eczema." It often appears as a group of little crusts on the face or ears, or on the scalp in cases of pediculosis, probably as a result of scratching. On the face the condition is easily cured, but the treatment is more troublesome when the scalp is affected. The treatment consists in removing the crusts after they have been softened by a boracic poultice. This is followed by the application of very weak white precipi-

tate ointment. Sometimes children are seen at school with ointment plastered over the crusts, but there is no use whatever in applying ointment until the crusts have been thoroughly cleared away. In the case of the scalp it is necessary for the hair to be cropped quite close.

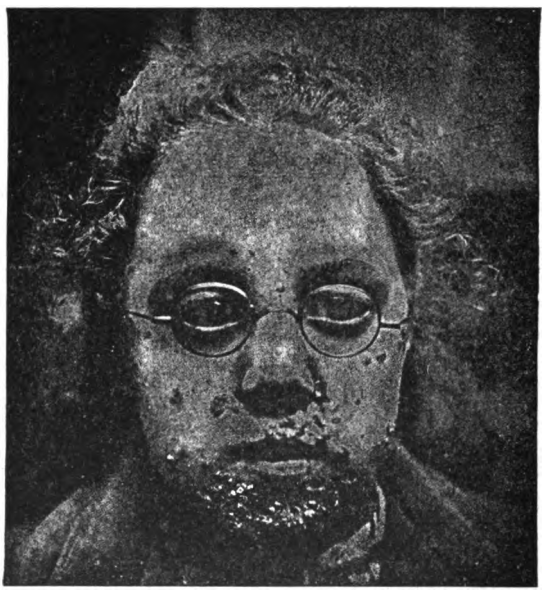


FIG. 37. Impetigo. (From *Skin Affections in Childhood*, by Dr. H. G. Adamson.)

Spectacles are being worn for squint.

Dandruff is the popular name given to a scaly condition of the scalp. The scales are shed as a fine powder. The affection lasts indefinitely. In course of years the scales tend to become greasy, and the hair to become thin. Washing the scalp weekly with a shampoo-powder containing borax is usually sufficient treatment.

NON-CONTAGIOUS SKIN AFFECTIONS

Urticaria, or **Nettle-Rash,** is a very common affection amongst children. It consists in the outbreak of a number of red spots with whitish centres, slightly raised and extremely itchy. The appearance of the spots is not unlike that of a bad nettle sting. The condition is of little importance, except that occasionally the eruption causes an alarm of measles. It is sometimes caused by some article of food which has disagreed, and no treatment is required beyond a dose of medicine. Itching may be relieved by sponging with a little baking-soda and water.

Herpes, or **Shingles,** consists in an outbreak of little vesicles, which begins near the spine and extends half-way round the body like a band. Sometimes the eruption spreads round both sides of the body, so as to form a complete girdle. The child is usually out of sorts, and complains a good deal of irritation in the skin. The treatment consists simply in dusting the eruption thickly over with flour and covering with a firm bandage. This relieves the irritation, and keeps the child from scratching. The child should be kept from school.

Eczema is the name given to a troublesome affection which is common at all periods of life. It occurs in a variety of forms. It is usually seen as red patches, very itchy, moist and sticky on the surface, or covered with scales or crusts. As a general rule both local and general treatment are required, and must be suited to the individual case.

Psoriasis is a fairly common affection in children over the age of five. It consists of dry patches, especially on the knees, elbows, and back. These are covered with silvery scales, and are not itchy. The child affected is usually in good health. Slight cases are often benefited

by scrubbing with coal-tar soap, but most cases require to be medically treated. The disease is amenable to treatment, but is very apt to recur.

Warts are little growths composed chiefly of the horny layer of the skin, and varying in size from a hemp-seed to a pea. They may be single or may occur in crops. They are unsightly, and their situation often makes them liable to injury. They may disappear spontaneously.

They are usually treated by the application of some caustic, such as glacial acetic acid or silver nitrate (remedies which must be used with caution), or by more radical methods, such as snipping them off with scissors.

Chilblains are very common in cold weather, especially in children whose circulation is feeble. They consist of bluish-red patches on the toes, fingers, or ears. They are very itchy, and the skin is liable to become broken.

The treatment should be directed chiefly towards improving the circulation by nutritious food, which should contain a fair amount of fat, and by active exercise, such as skipping. The hands should not be warmed at the fire. Woollen gloves should be worn out of doors. Thick woollen stockings should be worn, and care should be taken that the boots are not tight. Tincture of iodine is a useful application for unbroken chilblains. Broken chilblains should be kept clean, and dressed with zinc ointment.

SCHOOL BATHS

Professor William James includes cleanliness in his list of the instincts of children, on the ground that, if children are not very particular, most of them draw the line somewhere. But if cleanliness is an instinct, it is certainly not a very powerful one. So far as a considerable section of the school population is concerned, cleanliness has little chance of becoming a habit unless it is taught in school.

School baths may be advocated on the following grounds:

1. *Cleanliness.*—The home conditions of many children almost preclude the possibility of personal cleanliness so far as anything they can do is concerned. Dirty children are a danger to their neighbors. In some places school-going involves a daily exposure to foul air and filth contagions.

2. *Health.*—The skin cannot perform its important functions adequately unless it is kept clean. But the beneficial effects of bathing do not end with cleanliness. The application of water to the skin, followed by brisk friction, stimulates its activity, and improves the circulation, and exercises a tonic effect both on body and mind.

3. *Education.*—The educational purpose of school baths may extend beyond training in cleanliness to instruction in swimming and the treatment of cases of drowning. Every child should be taught to swim, not only because swimming is first-class exercise, but because life may some day depend upon it.

Varieties of School Baths — 1. *Slipper Baths.* — The ordinary slipper bath is chiefly useful in day-schools as an adjunct to the shower or swimming bath. Any which are installed should be provided with a very large outlet (say 4 inches in diameter) into a large pipe, so that the water which has been used can run out in a few seconds.

2. *Shower Baths.*—In Germany school shower baths have been extensively provided for many years, and the example is being copied in other countries, including Great Britain. The essential feature of the bathroom is a water-pipe provided with rose-showers at intervals of a few feet. The German bathrooms vary from a cellar with a concrete floor to a large airy room lined with white tiles or marble. There should be separate dressing places for each child, divided by partitions from one another. The children wash under a spray of warm water. The water gradually cools, and a sharp shower of cold water ends the bath. Proper super-

vision, of course, is necessary in order to see that the children not only wash properly, but dry themselves

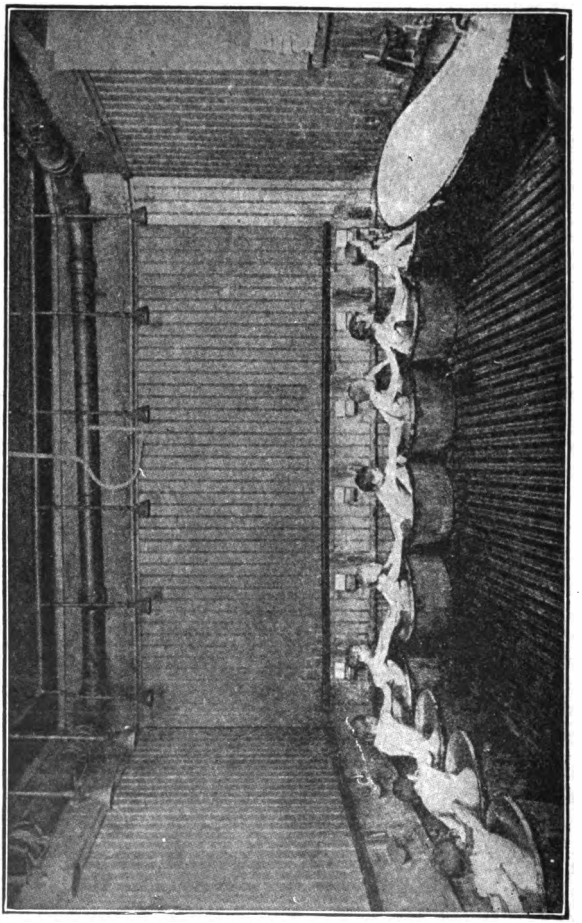


FIG. 38. School shower baths in Sweden.

thoroughly, and dress quickly. Such a system as this can be fitted up very economically, and ought to be fitted in all schools in poor neighborhoods.

3. *Swimming Baths.*—If it were not for the expense, a swimming bath would be regarded as an essential part of the equipment of a school. The expense may be kept within limits by making the bath of very moderate size, and by making one bath serve several neighboring schools. In some places the municipal baths are reserved at stated times for the use of school-children. When this is done the children should attend in batches under the charge of a teacher. It must, of course, be determined by medical inspection whether there are any children who ought not to be bathed, or who should not use the swimming bath. Children may require to be excluded from the bath either for their own sakes of for the sake of others. There is no doubt that various contagious diseases have been contracted by the use of swimming baths, and there are many diseases which might be conveyed in that way. In some public baths the water is sterilized by adding a disinfecting fluid, which is prepared by passing a strong electric current through a solution of certain salts. The medical officer of health for Poplar has reported very favorably upon this system. Water from a bath in use for three days was found to contain 10,000 organisms per c.c.; water from a bath to which the disinfectant had been added was found to contain, after three days' use, only 100 organisms per c.c. The cost of the disinfectant (prepared on a large scale) is about sixpence for the quantity necessary for a school swimming bath.

CLOTHING

In obedience to a tendency not yet extinct, man began to wear clothes primarily for adornment, and only secondarily for decency and protection. It is possible that "rational dress" might have achieved greater success if its advocates had been less oblivious of æsthetic con-

siderations. After all, a dress cannot be considered fully hygienic which does not give æsthetic satisfaction to the wearer.

In the case of children particularly, the requirements of primary importance in our climate are that clothing should be warm and light, and permit thorough freedom of movement. In all these respects children's clothing is too frequently deficient. Children more than adults require warm clothing because, owing to their smaller size, they part with heat more rapidly, and consequently are more liable to chill. No material in ordinary use is warmer than wool, which is a bad conductor of heat, and therefore prevents the heat of the body from escaping. Lightness can be secured by using a loosely woven material. Air being a bad conductor, any fabric which retains much air in its meshes is much warmer than the same amount of material closely woven would be.

Cotton and linen are both good conductors of heat, and are therefore inferior to wool from the point of view of warmth. When woven on the cellular principle, however, they retain so much air that they are much warmer than calico or linen cloth. Flannelette is warm and comfortable for the same reason, and is much used on account of its cheapness. Unfortunately it is so highly inflammable that many burning accidents occur every year from its use. A non-inflammable flannelette is sold, and should always be preferred to the ordinary variety for children's garments. The non-inflammable character, however, is gradually lost in the process of washing.

The absorbent qualities of the different materials are important. Wool is absorbent, but it absorbs moisture slowly, and also parts with it slowly, so that it does not feel cold even when the wearer is perspiring. Cotton and linen, on the other hand, soak up moisture rapidly, the water passing into the interstices of the fabric and evaporat-

ng quickly. Cotton and linen, therefore, feel cold and clammy when wet with perspiration.

Wool is therefore the most suitable of all materials in common use for underclothing, and knitted garments are warmer weight for weight than flannel.

With regard to outer garments, a new factor has to be taken into consideration—namely, color. Light-colored material is not only cooler in hot weather, but has the additional advantage from one point of view, that it soils quickly, and therefore requires to be washed. Material which is very closely woven, even if a good conductor, makes a warm, but not a very healthy, outer covering, because it prevents evaporation of the perspiration. Thus, a thin mackintosh over woollen clothing is found to be very warm.

Foot-covering, like clothing for the body, should be warm and light, and should not restrict movement. Woollen stockings, thicker or thinner according to the season, and flexible, well-shaped boots or shoes, best meet the requirements of our climate. Stockings should be supported by suspenders; and not by garters. Boots and shoes should be rights and lefts even for young children. They should be broad-toed and low-heeled, and almost straight on the inner side to suit the natural form of the foot. For young children sandals are preferable to either boots or shoes. They are lighter, and do not constrict the foot or interfere with its natural spread under the weight of the body. The objection to sandals is that they do not protect the feet from cold or injury so efficiently as either boots or shoes.

Clogs have recently been recommended by a doctor, moved by the dilapidated condition of much school footgear. Clogs are noisy and heavy, and rob the wearer of the natural springiness of his feet, but they are warm and cheap, and it must be admitted that a pair of clogs which kept

the feet warm and dry would be preferable to a pair of boots which did neither. Teachers are constantly confronted with the problem of what to do with children who arrive at school with feet soaking wet. The simplest plan, of course, is to do nothing, but it is a very dangerous one for the children. The alternatives are that children should bring a change with them; that the school should provide some sort of slippers; that the children should simply take off the wet things. Provided the room is warm, it is safer to have bare feet than to sit with wet stockings.

Defects in Children's Clothing.—Hygienic defects in children's clothing are very common among all classes of society, but naturally the worst defects are met with only amongst the very poor. Medical inspectors find children actually stitched into their clothes, which are worn night and day for months. Such children live in a sort of bath of perspiration. This not only makes them liable to constant chills, but contaminates the air they breathe. Miss Wilke (Chelsea) writes: "Of fifty schoolgirls, forty-five were found to wear the following garments: A pink flannelette chemise, a pair of pink flannelette drawers, a pair of stays with steel busks, two pink flannelette petticoats made with heavy pleats round the waist, one red flannelette petticoat, and finally a dress which was usually too tight across the chest. When one considers the double bands of the under-garments, it is plain that each child had from twelve to twenty thicknesses of material round her waist!"

The worst defects of children's clothing are only revealed when the children are stripped for bathing or for medical examination. But even among children who are well clad so far as the quantity and cleanliness of their clothing are concerned, faults in the distribution and the fit of the clothing are very common. Delicate children especially are apt to have far too much clothing on the chest, by way of protection from catching cold, while their limbs are

often not covered warmly enough. With regard to fit, it is only necessary to watch an average class engaged at Swedish exercises to see that a considerable proportion of the children, especially the girls, are physically incapable of carrying out many of the movements properly owing to the restrictions imposed by their clothes.

Clothing for Girls.—The following is an excellent arrangement of garments for girls up to the age of twelve or thirteen at least: Knitted woollen combinations, heavy or light, with sleeves or without; stout serge knickers buttoned to a flannel or cotton bodice, with or without sleeves; a tunic or dress. The advantages of this costume are simplicity, warmth, lightness, and comfort. The knickers are much lighter than petticoats, and equally warm. The corset is dispensed with. The clothing is suspended from the shoulders, and not from the waist. Moreover, all the garments can be varied in material and cut. When a tunic is worn, the costume is practically the same as the gymnastic dress worn in many secondary schools.

CHAPTER XIII

ACUTE INFECTIOUS DISEASES IN SCHOOL LIFE

ACUTE infectious diseases are of great importance from the teacher's point of view, because they are frequently contracted in school, because they greatly diminish the average school attendance, and because children who have suffered from them often require special care after their return to school.

Cause.—These diseases are due to minute organisms, known by such names as "microbes," "bacteria," "bacilli," and "cocci," which are able to live and multiply within the body. Some of these organisms, such as the diphtheria bacillus, can be grown in a laboratory, and recognized under the microscope. But the organisms responsible for some of the commonest diseases, such as measles, are not yet known.

Course.—Generally speaking, the acute infectious diseases pass through certain stages—namely:

1. *The period of incubation*, from the time of contracting infection till the appearance of definite symptoms. During this stage the germs of the disease are multiplying in the body, but the patient feels quite well, or perhaps just a little out of sorts.
2. *The period of invasion*, in which the symptoms declare themselves—in many cases by the appearance of a rash.
3. *The period of continuance*, during which the patient is more or less acutely ill.
4. *The period of decline or convalescence.*

How Infectious Diseases spread. — Infectious diseases generally spread directly from one person to another, the infection being conveyed by the breath or discharges from the body. Some of them, however, spread indirectly by means of contaminated water, food, or clothing. As a general rule the disease is not infectious during the incubation period, while the period of greatest infectivity is the period of invasion. Sometimes a child may, for a prolonged period, act as a disease "carrier," having suffered from an unrecognized attack of the disease, or even without having so suffered. The part played by the school in spreading infection must be considered separately with reference to the different diseases.

MEASLES

Measles tends to appear in epidemic form every two or three years, and interferes with school attendance far more than any other disease. Though commonly regarded as a trivial disease, it is the cause of some 13,000 deaths every year in England and Wales, besides laying the foundation of much future ill-health—the "dregs of the measles," as the mothers say. Most of the deaths result from complications, especially inflammation of the lungs, which are often due to want of proper care at the onset of the illness. Amongst the sequelæ may be mentioned tuberculosis of the lung, and, very commonly, chronic inflammation of the eyelids, attended by pain on writing or reading. The course of the disease is as follows:

1. *Incubation Period*, about eleven days, during which the child seems quite well.

2. *Invasion* is gradual. The child seems to suffer from a severe cold in the head with sneezing, a discharge from the nose, and redness and watering of the eyes. In three or four days a blotchy, reddish-purple rash appears on the face and ears, and spreads rapidly all over the body.

3. *Continuance.*—While the rash is coming out the patient is acutely ill, with a high temperature, and much cough and sneezing. When the rash is fully out, the temperature falls, and rapid improvement takes place, unless some complication has set in.

4. *Convalescence.*—After the rash subsides there is a desquamation of fine scales, which is often so slight that it is overlooked. As a rule the patient may return to school in three weeks from the onset of the illness.

Treatment.—Owing to the danger of complications, every child suffering from measles should be under medical care. The child should be kept in bed in a darkened room. After return to school, the special needs of the child will include abundance of fresh air and sunshine, moderation in exercise, and a minimum of book-work as long as tenderness of the eyes persists.

Measles and School Life.—Few subjects connected with school hygiene have been more discussed than the control of measles. Dr. Kerr and Dr. Thomas may be specially mentioned as having done a great deal of work with the object of finding out the effect of different measures of control in connection with the London County Council Schools. The great difficulty in the control of measles lies in the fact that the disease is extremely infectious during the invasion period. A child may therefore attend school for two or three days in an infectious condition, nothing being suspected until the appearance of the rash.

School closure is not effective in preventing measles, because other children have usually been infected by the time the first case is discovered. Some of these children are pretty sure to infect others even if the school is closed, and thus fresh cases appear in school soon after reopening. The chief effect of repeated school closing seems to be slightly to prolong an epidemic.

By suitable precautions measles may be postponed. This is an undoubted advantage, because the younger the child the greater is the danger of an attack of measles.

Precautions are most necessary in the infant department. In the senior departments measles is not apt to spread, because most of the children are protected by a previous attack. In the infant department the aim should be to *exclude the first case.* If the first case escape notice no subsequent precautions are very much use. To exclude the first case, teachers must be continually on the lookout, and send home *at once* every child who shows symptoms of an acute cold in the head. The teacher who will not act until she feels sure need scarcely trouble to act at all.

Ventilation has a considerable influence on the spread of measles. When measles appears in a school, the worse the ventilation, the larger the proportion of unprotected children who are attacked.

Disinfection of the school building is of no value in the prevention of measles, nor is there any necessity, except in the infant department, to exclude children from an infected house who have had the disease.

WHOOPING-COUGH

Of infectious diseases, whooping-cough causes the largest mortality next to measles. Death is usually due to bronchitis or pneumonia.

Incubation Period.—Seven to fourteen days.

Onset gradual, like a cold or bronchitis.

Continuance marked by severe paroxysms of cough, often associated with vomiting, during which the face becomes congested. The cough is followed by a long inspiratory whoop. This stage lasts three or four weeks.

Decline occurs gradually, and may be much prolonged in cold weather.

Whooping-cough is liable to cause trouble only in the infant department. It is spread directly from child to child, and the precautions to be taken are the same as for measles. It is most infectious in the early stages. How long the infection lasts is not certain, but probably not so long as the whoop. Indeed many authorities hold that the disease ceases to be infectious by the time the whoop is fully developed.

Every child suffering from whooping-cough should be under medical treatment, which can do a great deal not only to diminish the risk of dangerous complications, but to mitigate the symptoms which are of a very exhausting nature.

SCARLET FEVER (SCARLATINA)

Incubation Period.—Usually one to three days; it probably never exceeds seven days.

Onset sudden or rapid, with fever, sore throat, and a scarlet rash. Sometimes there is vomiting.

Continuance.—The rash fades in a few days, after which there is scaling or desquamation of the epidermis.

Decline.—The desquamation lasts about three weeks on the body, five or six weeks, or more, on the palms and soles.

Scarlet fever varies greatly in severity. In some epidemics it is a very fatal disease, but commonly it is milder than measles.

In school, scarlet fever is most frequent among children of five or six. It is not nearly so liable to spread as measles, partly because some children are not very susceptible to the disease, but chiefly because the sudden onset prevents affected children continuing to attend school. There is, however, a considerable risk of the disease being communicated after return to school. It is now generally believed that this danger is not due to persisting desquamation, but to discharges of some sort—for example, from

the ear, or from a throat not perfectly well. Children should therefore be medically examined before they are allowed to return to school. The minimum period of absence is six weeks.

Scarlet fever can be carried by a third person, and many outbreaks have been traced to infected milk.

Any child who takes ill suddenly in school and vomits on the floor should be sent home at once. The class-room should be cleared, the floor washed and soaked with some strong antiseptic, and the windows thrown wide open.

Children who have suffered from scarlet fever should be protected from cold. If any puffiness is noticed about the eyes, the case should be reported to the doctor, because the symptom may be due to a serious affection of the kidneys, which is a not uncommon result of the disease.

DIPHTHERIA

Diphtheria, the most dreaded of all infectious diseases, was formerly commonly attributed to "drains." As a matter of fact its mode of spread is nearly always direct from child to child. It can however, be carried by a third person, and may also be spread by infected milk.

Incubation Period.—One to five days, usually two or three.

Onset less sudden than that of scarlet fever. There is some sore throat, but often the patient is not ill enough stay in bed. A whitish membrane forms, usually on the tonsils or at the back of the throat.

Continuance.—A case which begins very mildly may get worse very rapidly after a few days. The "membrane" may spread to the larynx and interfere with breathing, so as to necessitate the operation of tracheotomy, or the patient may be poisoned by the absorption from the throat of diphtheria toxin.

Convalescence is gradual, and often very slow. Paralysis is a not uncommon sequela.

Nasal diphtheria is an uncommon form of the disease, in which the only symptom may be a copious discharge of thick matter from the nose. A child so affected would obviously be a source of great danger to other children if allowed to attend school.

Diphtheria is due to a bacillus which was discovered in 1883. If a swab of cotton-wool is rubbed over the throat of a child suspected of having diphtheria, and sent to a bacteriological laboratory, the bacillus, if present, can be discovered. If a child takes diphtheria, the source of the infection can often be found by taking a swab of all children in the class who have recently had sore throat, or even of every child in the class. Sometimes children who have not complained of sore throat are found to be "carriers" of the bacillus. By isolating such children, it is usually possible to obtain control of an outbreak of diphtheria without there being any necessity for, or advantage in, school closure. Before returning to school, children should be certified, after bacteriological examination, as being free from infection.

As diphtheria often begins like a mild sore throat, there are two good rules to be remembered: no child suffering from sore throat should be at school; and every child suffering from sore throat should be seen by a doctor.

The terrors of diphtheria have been greatly mitigated by the discovery of *antitoxin*, a remedy which has the remarkable effect of neutralizing the toxin or poison to which some of the worst symptoms of the disease are due. To be effective, however, *it must be given early*, because it cannot undo the mischief the toxin has already done. Let me, therefore, repeat that medical advice should be obtained whenever a child suffers from sore throat.

MUMPS

Mumps is characterized by an acute inflammation of the parotid salivary glands, which are situated in front of and below the ears. Sometimes the other salivary glands are involved.

Incubation.—About three weeks.

Onset.—There is pain, followed by swelling behind the jaw. Usually one side is affected before the other. The symptoms are apt to be more severe in adolescents than in young children.

The disease spreads directly from one child to another. The susceptibility of children varies considerably. Owing to the length of the incubation period, this disease may take months to "go round a family."

RUBELLA, OR GERMAN MEASLES

This disease has no connection with measles. It is very mild, and chiefly gives trouble owing to the rash being intermediate in appearance between that of measles and scarlet fever, for either of which it may be mistaken.

Incubation Period.—Twelve to twenty days.

Onset.—Symptoms slight. Often nothing is noticed till the rash appears. This spreads over the whole body, and lasts for two or three days, after which there is often a slight desquamation.

The disease is probably no longer infectious after the disappearance of the rash.

CHICKEN-POX (VARICELLA)

Chicken-pox is a trivial disease which may interfere with attendance in the infant department.

Incubation.—Fourteen to sixteen days.

Onset.—There may be slight indisposition before the rash appears.

Progress.—Often the first symptom noticed is the rash. This consists of a crop of little pocks, many of them oval in form, which contain clear fluid, and look like drops of water. Their number varies greatly. They appear all over the body, including the scalp. A few may form in the mouth. They are apt to become inflamed owing to the child scratching them.

Children suffering from chicken-pox should not return to school till all the crusts which form when the pocks dry up have disappeared. The chief points in treatment are to keep the skin clean and to prevent scratching.

In rare cases an attack of chicken-pox may give rise to a suspicion of smallpox, especially if cases of that disease have occurred in the neighbourhood.

SMALLPOX

Smallpox is a more virulent disease than any of those already mentioned. It is particularly fatal to children. In an epidemic in Montreal, of 3,164 deaths, 2,717 were under ten years. It is now a rare disease in Great Britain, but is still liable to break out in epidemic form when the conditions are favorable. Its present rarity is not due to improved sanitation, which has had no effect on the prevalence of measles, a disease which spreads in the same way as smallpox, from one person to another. The real explanation is vaccination, which affords a very high degree of protection from the disease. In Gloucester Cemetery lie the bodies of 279 unvaccinated children who died of smallpox during an epidemic in 1895–96, and of one vaccinated child.

The protection afforded by vaccination gradually wears off to some extent, so that people who have been vaccinated in infancy may take smallpox later; but the attack is

usually mild. Children suffering from such "modified" smallpox might even come to school. Consequently, when smallpox is known to be in a district, any skin eruption of pimples or pocks should be regarded with suspicion.

GENERAL REVIEW OF INFECTIOUS DISEASES

Three of the common infectious diseases—chicken-pox, rubella, and mumps—are so little dangerous that elaborate precautions to prevent them seem scarcely worth while. Children affected should be isolated during the infectious period, and where no doctor is in attendance the school medical service might supply the parents with information as to what can be done for the patient's comfort.

The three diseases mentioned have one feature in common—a very long incubation period. This raises a very interesting question. It is usual to exclude from school any child who has been exposed to infection until sufficient time has elapsed to show that he is not going to take the disease. This is called the quarantine of a "contact." But if a child who "catches" a disease does not become a source of danger to others till the end of an incubation period of about three weeks, why should he be kept from school all that time? The periods of quarantine given in the table (p. 197) are those generally accepted,* but many authorities hold that it is quite sufficient to exclude contacts during the period in which symptoms are liable to appear—namely, for chicken-pox, from the eleventh to the twenty-second day after exposure to infection; for mumps, from the thirteenth to the twentieth; and for rubella, from the ninth to the twenty-second.

The rest of the affections treated of in this chapter should

* See *A Code of Rules for the Prevention of Infectious Diseases in Schools*, issued by the Medical Officers of Schools Association (Churchill, 1910).

be regarded as dangerous diseases, against which all possible precautions should be taken. A large section of the public has no idea that this is the case. It is considered that such "children's ailments" are inevitable, and of but trifling importance. I have myself found a child playing in the street when at the very height of measles, with pneumonia commencing! There can be no doubt that a large part of the mortality from measles and whooping-cough could be prevented by better education of the public. Some additional points regarding scarlet fever and diphtheria are of interest. During the last fifty years the mortality from scarlet fever has declined very greatly, partly because the disease is less prevalent, and partly because the cases are rarely so severe. The mildness of many cases and the adoption of the view that the desquamation is non-infectious are leading many medical officers to question the necessity of a minimum isolation period of six weeks. Some have had the courage of their convictions, and during 1912 the *average* detention of scarlet fever cases in Leith Hospital was only 29·8 days. Dr. Robertson states that he keeps the wards flooded with fresh air and sunshine, and that the patients leave strong and well—a great contrast to the condition of patients on discharge when it was the custom to keep the wards very warm and the windows closed.

Diphtheria offers a strange contrast to scarlet fever, for, although it has lost much of its terror since the introduction of antitoxin, it is nevertheless much more widely prevalent than it used to be, and the total fatality has increased. This may be partly accounted for by the great increase in the proportion of the population living in towns, and partly by the fact that before the bacteriological method of diagnosis was known, large numbers of cases of diphtheria were certified as membranous croup, croup, quinsy, or sore throat.

TABLE OF INFECTIOUS DISEASES.

(See "General Review of Infectious Diseases" as to modification of some of the periods mentioned.)

Disease.	Incubation.	Day of Definite Illness on which Rash appears.	Chief Signs.	Period of Exclusion from School.	Quarantine.*
	Days.				Days.
Measles	Usually 10 to 12	3rd or 4th	Begins like a cold in the head, with watering eyes, fever, cough, blotchy rash.	Three or four weeks, according to fitness.	16
Scarlet fever . . .	1 to 7	1st or 2nd	Sudden onset with sore throat, vomiting, rash; later, desquamation.	Till desquamation and discharges have ceased (not less than six weeks).	10
German measles .	About 18	1st to 3rd	Slight fever, with rash sometimes resembling measles, sometimes scarlet fever.	Two or three weeks.	20
Whooping-cough .	7 to 14	No rash	Begins like a cold, with cough, and soon whooping, often with vomiting.	Till cough has ceased (eight weeks).	21
Diphtheria	2 to 5	No rash	Sore throat, often mild at first, with whitish patches on tonsils or back of throat.	Till bacilli have disappeared from affected part (six weeks).	12 If no bacilli in swab (p. 192)
Mumps	21	No rash	Swelling and pain at sides of face.	One week after subsidence of swelling.	24
Chicken-pox . . .	14 to 16	1st to 3rd	Eruption of small vesicles like drops of water.	Till all scabs have fallen off (about three weeks.	20

* Quarantine is the time a child exposed to infection must be kept from school to see whether he is going to take the disease. The time counts from the latest chance of infection.

Diphtheria and scarlet fever have two points in common: they are apt to be prevalent together in certain schools, sometimes for a prolonged period; and certain children infected remain infectious for an indefinite time. The children who are most apt to become carriers are those who have some chronic affection of the throat such as enlarged tonsils. This statement enables us to complete a lesson which has already been given in part:

1. Abundance of fresh air and open-air exercise, supplemented by "respiration drill" and attention to any symptoms that arise in connection with the mouth, throat, or nose, will keep these parts in a healthy condition.

2. With these parts healthy, the child's susceptibility to infectious disease (especially scarlet fever and diphtheria) is lessened.

3. If he is infected, the attack is more likely to be mild.

4. After recovery he is less likely to be a "carrier."

SCHOOL CLEANING

Dirt is a foe that requires to be fought. Dirt and disease go hand in hand. Dr. Harman states that in thirteen schools which he examined eye affections were more than twice as prevalent in those which were below the average cleanliness as in those which were above the average. The statement may safely be extended to include other affections, especially skin diseases and affections of the nose, throat, ear, and lungs. Schools should be kept clean for the sake of health; they should also look clean for the sake of education.

Sources of Dirt in Schools.—The dust of schoolrooms contains particles derived from the wear and tear of clothes, books, furniture, and apparatus; chalk, ash, and soot; dried secretions from the skin, mouth, and nose; organic and inorganic matter carried in by the wind, especially in

the case of schools built too near the public road. Much dust and dirt are carried in by shoes and clothing. Microbes are also abundant, especially those which cause decomposition of organic dirt on the children's bodies or in the room.

Methods of Cleaning.—Schools should be cleaned daily. The daily cleaning should include thorough sweeping (under all desks, seats, foot-rests, etc.). Before sweeping, the floor should be sprinkled with wet sawdust, unless it has been treated with oil sufficiently recently to prevent the rising of dust. The furniture should be thoroughly dusted with a duster just damped with paraffin, and then rubbed with a dry cloth. This is good for the furniture, and leaves no smell. The windows should be left widely open after cleaning.

Floors of class rooms, cloak rooms and corridors, and stairs should be scrubbed with hot soap and water as often as may be necessary to keep them sweet and clean. If teachers' platforms exist, these should be moved and the floor washed underneath.

Windows should be kept bright and clean. In many situations a weekly cleaning would not be at all too frequent, whereas once a term is often the regulation allowance, with the result that the lighting of the class rooms is seriously interfered with.

Dustless floor oils are used in some schools. The chief objection to them is that they darken pine floors and make them look dirty. They do, however, diminish the amount of dust in the air, and are therefore particularly useful for application to the floors of gymnasiums and halls where drill and dancing are carried on. A fresh application should be made during the vacations several days before the floors are to be used.

Disinfection.—Two views are held with regard to the disinfection of schools. According to one view, routine

disinfection is of no value. Infectious diseases spread by direct infection from child to child. The means useful for preventing their spread are: Prompt isolation of *suspicious* cases, thorough ventilation both during and after school-hours, efficient and frequent cleaning, and the inculcation of cleanly habits. Such habits as sucking pencils, holding pens or pencils in the mouth, spitting on slates or elsewhere, coughing without holding something in front of the mouth, or licking the finger before turning over the leaf of a book are always objectionable, and sometimes dangerous.

According to the other view, thorough disinfection of schools should be carried out periodically, whether infectious diseases are prevalent or not. It cannot be said that there is decisive evidence in favor of the routine disinfection of all schools. But some schools are much more difficult to keep clean than others. Consequently, routine disinfection might improve the health conditions and the school attendance in some cases, and be of no value in others. The inadequate cloak rooms of many schools seem to call for something stronger than soap and water. Disinfectants should never be used to overcome offensive smells, the source of which should be discovered and attended to.

The question of the disinfection of schools and school appliances is one for the medical officer to decide. The disinfection should be carried out by the public health authorities, and books used by an infected child should be sterilized at the public disinfecting station.

CHAPTER XIV

THE SCHOOL

A. THE CLASS-ROOM

A SCHOOL should be thought of as a number of class-rooms collected into a single building rather than as a building divided into so many class-rooms. If this idea had been kept in view, a good many existing schools would have had to be differently arranged. The class-room is the most important part of the school. What are its ideal requirements?

Study of an Actual Class-Room.—The study of the class-room may very well be begun by finding answers to the following questions with regard to some existing school-rooms. (A hint for a lesson in applied arithmetic.)

What is the area of the floor in square feet?
How many square feet per child?
What is the size of the room in cubic feet?
How many cubic feet of air-space per child?

If the room is lofty, it may be counted as 14 feet in height, because greater height is of no special advantage, so far as utilizable air-space is concerned.

When answers have been found to these questions, they must be compared with the measurements which the best authorities on school hygiene consider desirable.

Floor Area.—The Board of Education allowance of 10 square feet per child is regarded as insufficient by leading authorities, who demand 14 or 15 square feet. The cubic space per child should be about 200 cubic feet.

In form, the room should be oblong, approximating the square, but not too closely, and the desks should be arranged across the shorter measurement. The width of the room should not be over 25 feet, nor the length over 30 feet. A room 30 feet by 25 feet by 13 feet would accommodate forty-eight pupils, giving each of them slightly over 15 square feet of floor space and slightly over 200 cubic feet of air space.

These are the dimensions recommended by Professor Shaw of New York. Can they be accepted as ideal? Many authorities in Great Britain would not accept them as such. A length of 30 feet should be regarded, not as the optimum, but as a maximum for a class-room in an elementary school. A greater length imposes a strain upon the teacher's voice, and causes the children sitting in the back to strain their eyes in looking at the board. A breadth of 25 feet may not be too great if the lighting conditions are perfect, but one cannot count upon perfect lighting conditions throughout the school day in a town atmosphere.

In England class-rooms are frequently made 24 feet 8 inches square. This gives an allowance of 10 square feet of floor space to a class of sixty children. When classes are reduced to forty, these rooms will give the ideal allowance of 15 square feet of floor space per child. Now, in these rooms the desks farthest from the windows are often found to be insufficiently lighted. Consequently it has been recommended that class-rooms with unilateral lighting—the ideal form—should not be over 20 feet in breadth. This would give us a room 30 feet by 20 feet for a class of forty children. If we accept the *proportions* recommended by Shaw, we would have a room of about 26 *feet* by 22 *feet for forty children*. The practical point is that the breadth of the class-room should be determined by the lighting conditions.

Lighting.—It has already been stated that the windows should equal at least a fifth of the floor space, and that

class-rooms should be lighted from the left. The spaces between the windows should be small, so as to avoid bands of light. The windows should reach up to within 6 inches of the ceiling, because more light comes from the upper part of the window than the lower. The sills may be $3\frac{1}{2}$ to 4 feet from the floor. If there are subsidiary windows to the right, these should be near the ceiling. In that position they will be useful for ventilation, and the light from them will be reflected down from the ceiling. It is a curious fact that windows into a hall or corridor may actually diminish the lighting of the class-room, but it has been found by experiment that the desks nearest the wall may really be better lighted by the reflection from a light-colored wall than by such windows.

Aspect of Class-Rooms.—In the British Empire on which the sun never sets, there ought not to be class-rooms into which the sun never shines, yet many class-rooms are badly oriented for no other reason than that the architect did not give one moment's consideration to the question. The window side of the class-room should face south—more or less. A little to the east will give the morning sun, which is much to be desired; a little to the west will lessen the need for artificial light on winter afternoons.

Arrangement of Class-Rooms.—Although young children should have as large an allowance of floor and cubic space as older ones, their seats and desks may be arranged more closely, the advantage of this being that more floor space is left free for occupations involving motor activity. It is better that there should not be a raised gallery. The objections to the gallery are that it occupies space, and creates a large number of corners in which dust may collect, and that fermenting organic matter, which may gather in the space under it, may cause contamination of the air of the room. With a moderate-sized class, neither

gallery nor teacher's platform is necessary. If there is a platform, it should be movable, and the floor underneath it should be kept clean.

The blackboard, if fixed, should be placed in the centre of the wall facing the children. If the room is not very well lighted, the board should be fixed nearer the window side of the room, but not too much, or the children on the other side of the room will have to twist round in order to see it. In a bright room, the board should have a slight slope, so as to prevent reflections reaching the children's eyes.

The Infant Room.—Children ought not to go to a school of the ordinary kind until they are six—and many children are not six until they are seven (*vide* p. 20). "They manage this matter better in France." In that country, and in most others, the school age is six. In Scotland the age is five, and practically no children are admitted younger. In England, on the other hand, nearly 10 per cent. of the accommodation in elementary schools is for children under five. Children under five should spend the bulk of their waking hours in a nursery or a garden. If social circumstances are such that it is better for them to go to some kind of school, the school should be of the nursery type—that is to say, the school should be a kindergarten school, not a kindergarten department in an ordinary school. No elaborate building is required. The Montessori schools in Rome are simply nursery-rooms included in their tenements by a building society for the joint use of the tenants. The free kindergartens in Edinburgh are houses or part of tenements rented for the purpose. A recent Glasgow kindergarten is a simple wood and concrete structure.

The infant room should have ample floor space, not for sitting still, but for moving about. The floor should be covered with linoleum. A plain linoleum of dark green is, perhaps, to be preferred. The windows should be large,

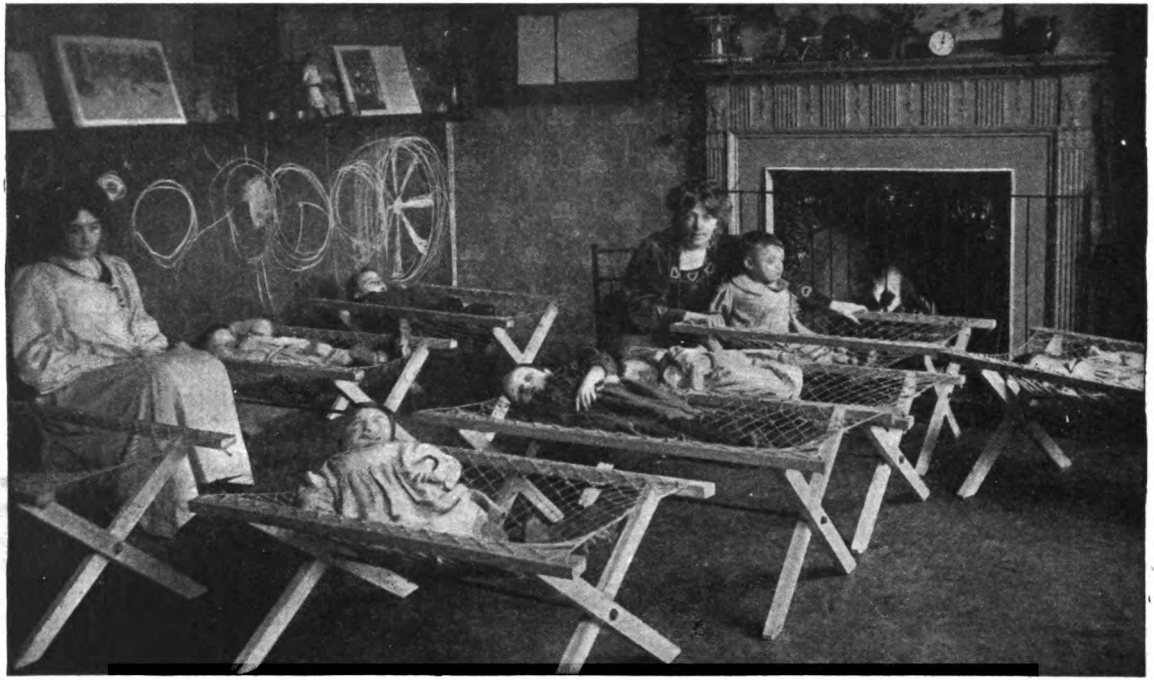


FIG. 39. "Rest-Hour." The child in front is posing in case she might be left out of the picture!

and may be on three sides of the room. They should open easily and freely, and some of them should catch the forenoon sun. They should have low sills, so that the children may see the world outside. Blackboards for free-arm drawing may be fixed to the walls, which should be light in color, and painted with oil paint.

Warming should be by coal fires in properly constructed grates (*vide* p. 219), securely guarded.

The furniture should consist of little chairs and low tables broad enough and solid enough not to be easily upset, and light enough to be carried easily by two children. The angles and corners of the tables should be rounded in case a child may fall against them.

There should be easy access to the garden, and to the cloak-room and lavatory. Overalls (washable, of course) and slippers should be provided either by the parents or the school. Every child should have a handkerchief, which should be kept in a pocket, and not, as is sometimes done, allowed to depend from a safety-pin, contaminating everything with which it comes in contact.

The Gymnasium.—It is unnecessary to enter into particulars regarding all the departments of a school, the hygienic requirements of which must be determined by general principles; but a few words must be said about the gymnasium, because it is often found that in no other part of a school are hygienic laws more openly defied. Active exercise quickly increases both the rapidity and the depth of respiration. It is obvious, therefore, that very free ventilation should be regarded as absolutely essential for any place where physical instruction is given. Yet the gynmasium is often worse ventilated than the class-rooms. Not long ago a new gymnasium was provided with large windows on one side only, but not one of the windows was made to open, and the only ventilation was by means of a single movable pane in each window.

The gymnasium should also be well lighted. No doubt much wall space is required for apparatus, but that is no reason why the windows should be little better than port-holes somewhere near the roof.

The prevalence of dust is a serious fault in many gymnasia. Naturally, any dust there may be is liable to be stirred up and inhaled. Attention should therefore be paid to the thorough cleansing of the floor, walls, and apparatus. The use of dust-retaining floor oils, already referred to, is particularly desirable in the gymnasium. All mattresses should be covered with leather, and kept in good repair.

B. THE SCHOOL BUILDING

The Site.—The spot selected for a school should be moderately elevated, with a slight slope to facilitate drainage. The soil should be porous—*i.e.*, gravel or sandstone, rather than clay—and free from decomposing organic matter. The immediate neighborhood should be free from any conditions liable to pollute the air or to give rise to risk of accidents. It should also be as quiet as possible.

The Building.—The essential requirements of the building are that every class-room should have an abundant supply of *fresh air*, the maximum amount of *daylight*, and direct *sunlight* during part of the school day.

The building, therefore, should be open on all sides. A good rule is that a line from the foot of the wall of the school building to the top of the nearest building should not make an angle of more than 30 degrees with the horizon. This rule provides for the free access of light and air. The building should stand well back from the street, so as to be out of the way of dust and noise.

The building should be soundly constructed of good material, but money should not be wasted on useless ornamentation. Its beauty should reside in its simplicity

of line, and its fitness to its purpose, and to hygienic requirements.

A *basement*, with a damp-proof course, should extend under the whole building, but the school itself should be limited to two stories above the street, as excessive stair-climbing imposes a strain on the pupils.

Entrances should be separate for each department, and there should be sufficient to permit the rapid emptying of the school in case of alarm. The entrances should be wide, and the doors should open outwards as well as inwards. If there are outside steps, there should be a broad landing between them and the door.

Corridors should be from 10 to 12 feet wide, and should be well lighted. They should not be used for hanging clothes.

Floors should be sound-proof. The boards used should be of the best quality, and thoroughly seasoned, and all cracks should be filled. Solid blocks are sometimes used, but they are apt to work loose, or to wear unevenly and they increase the crevices in which dirt may lodge.

Internal wall surfaces should be of non-porous plaster, which can be washed. Ordinary porous plaster, colored with distemper, is liable to absorb moisture and organic matter, which may ferment and give off injurious gases. Glazed bricks or enamelled tiles are excellent for lining the lower parts of the walls of outer lobbies or much-used corridors. Wainscot boards should fit closely, and should be painted with oil paint. There should be no cornices or projections on which dust can lodge, and the tops of doors and windows should be bevelled off. Pictures should be hung on nails.

Staircases should be fireproof, and there should be at least two to each floor. These should not be placed together in the centre of the building, as this is a dangerous arrangement in case of fire; nor should they have solid walls on

both sides, as a stair so constructed readily fills with smoke.

The staircase should be at least 5 feet wide, and should be broken by landings, both to rest the muscles of the children in ascending, and to diminish the risk of accidents. No triangular steps or "winders" should be used. Each step should be about 12 inches broad, and $5\frac{1}{2}$ to 6 inches high.

There should be a handrail on each side sufficiently low for the smallest children using the stair. The upper rail should be guarded to prevent pupils sliding down. Fully

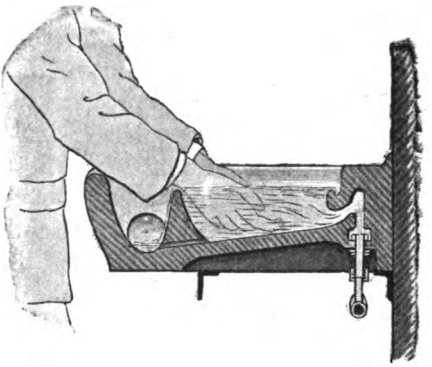


FIG. 40. Clarifont basin, with continuous flow.
(By permission of Messrs. MacLeod, Glasgow.)

enclosed stairways are sometimes recommended to prevent the possibility of children falling over the balustrade.

Cloak-Rooms and Lavatories.—Cloak-rooms should not be passages, but special rooms, well lighted, and with gangways 4 feet wide between the hanging rails. The best way to arrange the clothes is by means of hooks on metal stands so disposed as to afford a free circulation of air. Cloak-rooms should be well warmed and ventilated, so that damp garments may dry quickly and the emanations from them pass to the outside. To prevent congestion, there should be a separate entrance and egress.

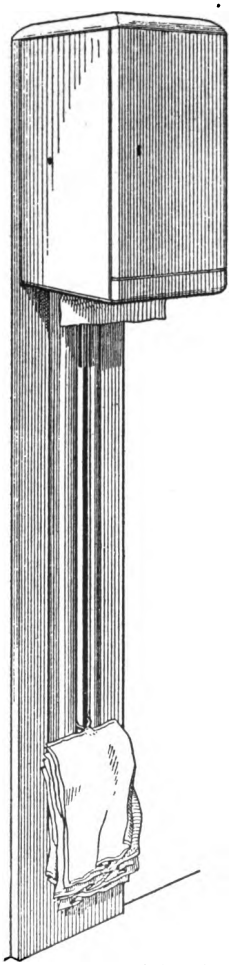


FIG. 41. Towel distributor.
(*By permission of Messrs. MacLeod, Glasgow.*)

There should be ample lavatory accommodation contiguous to the cloak-rooms as well as to the closets. The best basins are those made of glazed earthenware. To prevent children washing in water some one else has used, continuous-flow basins may be used, or, better, the children may use water gushing from taps into a long trough, from which it escapes at once. To prevent waste of water, the janitor can cut off the flow when it is not required.

The ordinary yellow soap is preferable to so-called disinfecting soaps. Clean towels should be provided every day. The "one-each towel distributor" is a useful invention. Teachers should visit the lavatories occasionally to see that they are kept clean, and properly used.

Water-Supply. — Water supplied for drinking should be pure and plentiful. In country districts especially children should be warned of the danger of drinking polluted water. Shallow wells—that is to say, wells which do not pass through a stratum impermeable to water—are very apt to be polluted, and any well in the neighborhood of inhabited dwellings should be regarded as suspicious.

Drinking-fountains should be provided with drinking-cups, and children should be taught to rinse these out well

before using them, and to look at the water before drinking. Some writers recommend drinking-fountains at which the child drinks by placing his mouth at the top of a jet of water 2 or 3 inches high. Such "hygienic fountains" obviate any risk there may be of infection from a drinking-cup, but children are apt to swallow air while drinking. They will also take the nozzle in their mouths, which may be quite as dangerous as drinking from an imperfectly rinsed cup.

Sanitary Arrangements.—According to the Board of Education code, "water-closets within the main school building are not desirable, and are only required for women teachers. All others should be at a short distance, and completely disconnected from the school." "Each closet must be not less than 2 feet 3 inches wide, nor more than 3 feet, *fully lighted and ventilated*, and properly screened or supplied with a door." There must be separate provision for boys and girls, the number of closets required being as follows:

Number of Children.	For Girls.	For Boys.	For Infants.
Under 30	2	1	2
Over 30 and up to 50	3	2	3
" 50 " " 70	4	2	3
" 70 " " 100	5	3	4
" 100 " " 150	6	3	5
" 150 " " 200	7	4	6
" 200 " " 300	8	5	7
		Urinals in	proportion.

In country districts, dry-earth or ash-closets of an approved type may be used; but wherever there is a water-carriage system, water-closets must be provided. These should be of the "wash-down" variety. This consists of a basin which ends below in a wide S-shaped bend or trap. This always retains water, which prevents gases passing up

from the drain. Hence the water is called the "water-seal." The closet should be washed out after use by means of a siphon cistern holding $2\frac{1}{2}$ or 3 gallons. Whenever such a cistern is started, it empties automatically, thus insuring a good flush. The closets should never be enclosed in woodwork. Other forms of closet are sometimes used, but are less satisfactory than the "wash-down." The worst is the old-fashioned pan-closet, which cannot be kept clean, and always gives off offensive gases.

The seats of the closets should be low—as low as 6 inches—because this necessitates a posture in which the front of the abdomen is supported by the thighs. The risk of rupture from straining may thus be averted. This is a very important matter, particularly in the case of some of the younger boys.

C. VENTILATION

In a well-ventilated room, work can be done more easily, and with less mental or physical fatigue, than when the air is vitiated. In a school-room insufficiently ventilated, the air soon becomes oppressive and offensive from contamination by the products of respiration (p. 114), emanations from persons and clothes, and dust stirred up by movements. In the past, the air space in class-rooms has been proportional to the size of the children, but this was a mistake, for children, owing to physiological differences, require as much air as adults. Increasing the air space will not solve the difficulty, for it cannot be increased indefinitely, and big rooms are more difficult to ventilate than small ones. Moreover, good ventilation involves a good deal more than the maintenance of the chemical purity of the atmosphere. Comfort is largely dependent upon the temperature, the movement, and the humidity of the air.

The proportion of carbonic acid in the air is taken as a

gauge of purity, because it is easily estimated. It is not the chief offender in a stuffy room, but it is known to keep bad company. In fresh outside air the proporion of carbonic acid is 0·04 per cent. When it reaches 0·08 per cent., a room begins to feel close. The sanitarian therefore demands that in a class-room the carbonic acid must be kept down to 0·06 per cent. To do this, it is necessary to pass into the room at least 30 cubic feet of air per minute for every child, even allowing for what finds its way in by diffusion through the walls. How to accomplish this is a problem which engineers have solved by mechanical ventilation. This we shall describe before considering two alternative systems—the "gravity" and the "natural."

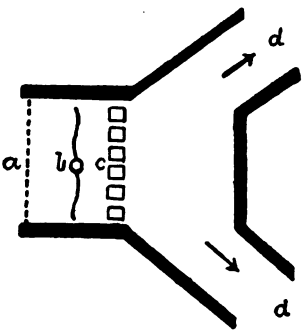


FIG. 42. Diagram of mechanical ventilation. *a*, Wet screen; *b*, fan; *c*, hot pipes; *d*, to class-rooms.

Mechanical Ventilation (Plenum or Propulsion System). —This is effected in the manner shown in Fig. 42. In the basement of the school an engine drives a large fan, by which air is drawn in. The air is drawn through a wet jute screen to free it from dust, and passes between the tubes of a hot coil, by which it is warmed. It is then driven through ducts into the various class-rooms, and it has been found by experiment that the best results are obtained when the entrance for the fresh air is near the ceiling, and the exit for the air driven out is in the same wall near the floor. This system is costly to install, and requires skilled supervision, but engineers may fairly claim to have solved the original problem. They have proved that it is possible to drive into the class-rooms any required quantity of air at any required temperature, thus solving

the warming problem too. Yet teachers in mechanically ventilated schools commonly complain that the air feels oppressive, and gives rise to headache and sore throat; that they are unduly fatigued by their day's work; and that the absence of open windows is a bad lesson for the children. Certainly it is an anomaly to hear a teacher telling children that windows should always be open in a room where the windows are always shut.

Some of the drawbacks complained of can be mitigated. Part of the discomfort experienced is due to the lack of moisture in the air. The warmer air is, the greater is its capacity for absorbing moisture. Consequently, when cold air is heated, its "relative humidity" is lowered. For comfort, the humidity of the air should be not less than 50 per cent., but in cold weather the relative humidity of the warmed air is likely to be much less than this, unless there is a special arrangement—usually neglected—for adding sufficient moisture to the air *after* it is warmed. The passage of the unwarmed air through a wet screen is not enough. Other partial explanations of the defect in the atmosphere are charring of dust particles in the air by the hot pipes, and increased air-pressure in the room.

To sum up, *at its best* this system works well, and is specially suitable for schools of the central hall type; but it is costly, it is unnecessary, often it is not at its best, and rarely are the drawbacks mentioned completely overcome.

The Gravity System.—Fresh air passes directly into the class-room from outside through special ventilators near the floor. In cold weather it is warmed by passing over radiators. The warm foul air in the room rises, and escapes through an opening into a special exit shaft. This system is not inexpensive, but its operation is apt to be too much influenced by the weather. To overcome this, an extraction fan may be placed in the exit shaft, but strong ex-

traction involves the risk of drawing air into the class-room from undesirable sources—*e.g.*, through the floor.

Natural Ventilation.—By natural ventilation is meant ventilation by the natual diffusion of gases, aided by windows, doors, chimneys, or ventilators, but without mechanical assistance. Class-rooms mechanically ventilated have frequently been found to have a much better atmosphere, judged solely by the proportion of carbonic acid, than those of neighboring schools ventilated by natural means; so much so, that Dr. Kerr a few years ago declared that "natural ventilation, in fact, means no ventilation at all." This statement, however, rather gives away the case for mechanical ventilation, for it is not much to say of a system, carefully designed and carefully carried out, that it is superior to "no ventilation at all." The growth of the "fresh-air cult," added to the unsatisfactory features of the plenum system, has raised the question whether natural ventilation would not prove satisfactory if sufficient attention were bestowed upon it. The answer to this is in the affirmative. The conditions necessary are—(1) Ample provision for cross-ventilation; (2) windows which open very easily, and admit of a large proportion of the window being thrown open quickly for the flushing of the room. These conditions can be secured most readily by abolishing the central hall, and making the class-rooms open on to a veranda, as has been done in a good many recent schools built on the Staffordshire type. The first school of this type is shown in Fig. 45. The windows are provided with large hopper openings, which can be kept permanently open in any ordinary weather. This system is found in practice to be inexpensive, efficient, pleasant, and healthy. Its success depends a good deal upon the teacher, but there can surely be no doubt that teachers will rise to the occasion. Indeed, the success of open-air schools in improving the health of delicate children

has been so marked that teachers themselves are asking why all children should not have the benefit of open-air methods so far as these are applicable to ordinary schools.

Ventilating Windows.—The ordinary kind of sash-window, as a ventilator, leaves a good deal to be desired. Hopper windows have, therefore, been provided in many new schools, with the object of directing the entering current of air upwards, and so preventing draughts. Many hopper windows, however, are defective, inasmuch as the greater part of the window cannot be opened. A much better window has been invented by Captain Chaddock. This window has a small upper portion, which opens inwards on a horizontal central axis, and a large lower portion which revolves on a vertical central axis (Fig. 43). These two movements are effected by simply turning a handle. If desired, practically the whole area of the window can be open at once. The direction of the currents of air entering the room can be regulated by the position of the sashes. A special claim made for these windows is that by their means efficient natural ventilation can be secured in rooms where there is no provision for cross-ventilation. Thus, if a room has three windows at one side, the side windows can be so arranged that two currents of air enter the room in opposite directions. These sweep gently round the room till they meet, when they pass across the room and leave by the central window.

D. HEATING

The chief means adopted for warming schools are—open fires, warm air, steam, and hot water.

Open Fires.—Fires warm a room chiefly by *radiant heat*, that is to say, heat which warms the floor, walls, and objects in the room without heating the air. The air is warmed by convection from warm surfaces in the room. A room

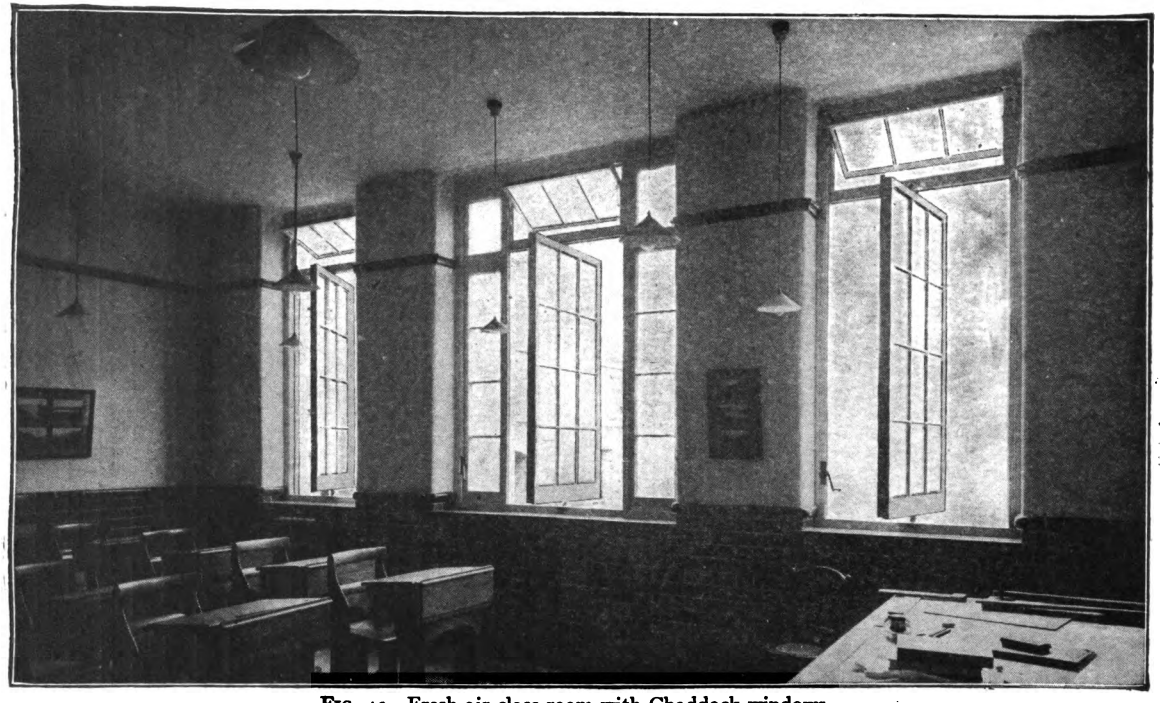


FIG. 43. Fresh-air class-room with Chaddock windows.

warmed in this way feels comfortable at a lower temperature than one warmed by hot air. When the floor and walls are warm, a room will feel comfortable at a temperature of 56° to 60° F., but when the walls are cold people may feel chilly in a room the air of which is considerably over 60° F. In America, for example, where the walls of the schools are excessively chilled owing to the severity of the winters, it is customary to keep class-rooms, warmed by hot air, at a temperature of 70° or 75° F. Now, as cold air is stimulating and warm air enervating, radiant heat is the most healthful method of warming a room, and open fires are not only cheerful and pleasant, but hygienic. A fire also assists ventilation by causing a strong draught up the chimney.

The disadvantages of the ordinary fire are as follows: The room is warmed unequally. A large proportion of the heat is wasted by passing up the chimney. A great deal of work is involved in attending to the fires. Dust and smoke pass into the rooms. Accidents may happen to children through clothing catching fire.

Wherever open fires are used, it is important that the grate should be properly constructed so as to minimize the waste of heat. The principles of grate construction laid down by Teale many years ago are gradually being adopted by manufacturers. According to Teale, a grate should have as much fire-brick and as little iron as possible in its composition. The back should lean over the fire. The throat of the chimney should be narrow. The fireplace should be broad in front and narrow behind. The slits at the bottom of the grate should be very narrow. The bars in front should be vertical and close together. Once the fire is started, an "economizer" should block up the front of the space under the grate, so as to prevent air passing into the fire from underneath.

In addition to these points in construction, the grate

should be of a ventilating pattern. Such a grate is surrounded by an air chamber. Air passes into this from outside, and after being warmed by the hot fire-brick, rises into the room through a special aperture above the fireplace (Fig. 44).

Grates presenting the above features have obvious advantages for the warming of class-rooms where the natural system of ventilation has been adopted. There is another way in which the heat of the back of the fires may be utilized, and that is to warm the water for hot-water radiators in the class-rooms. This plan has been adopted in a school recently erected in Edinburgh (Fig. 47).

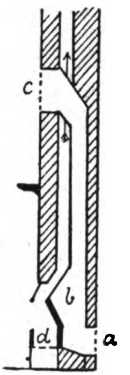


FIG. 44. Galton's ventilating grate (in section). Air entering at *a*, is warmed in the passage *b*, and escapes into the room at *c*. *d*, fireplace. ➤, chimney.

Hot Air will naturally be used for warming purposes wherever the plenum system of ventilation is in use. It need not be further referred to.

Steam and Hot-Water Apparatus.—Steam heating is generally considered unsatisfactory for schools. It is cheaper to install than a hot-water system, but is rather more expensive in management. It requires constant attention, and the regulation of the heat is difficult. A low-pressure hot-water system is more suitable, the heating surface being either pipes or radiators. Pipes distribute the heat well. They should be sufficiently raised and sufficiently far from the wall to be easily cleaned. Radiators have the advantage that they can be so placed (*e.g.*, under the windows) as to warm air passing over them into the class-room. As radiators dry the air, a porous earthenware vessel containing water should stand on the top of each. This vessel should be as long as the radiator, and not a mere saucer.

Stoves are very economical of fuel, but are less healthy than fires. Some stoves, indeed, are positively dangerous, as they liberate carbon monoxide, a very poisonous gas. The ordinary cast-iron stove is not sanctioned for school use by the Board of Education, but certain patterns of ventilating stove are permitted. Gas stoves have been greatly improved in recent years, and some forms are unobjectionable on hygienic grounds.

The Temperature of the Class-Room.—Every class-room should have a thermometer hanging sufficiently far from the source of heat, and out of the line of draughts. A large chart on which the fluctuations of room temperature can be recorded is an interesting object-lesson, whose value can be increased by recording the outside temperature for comparison. The temperature of the room should be about 60° F. In ordinary weather, and with a class of robust well-clad children, it may be a little less; in very cold weather, in a room that gets no sun, or with children thinly dressed or with chilblains on their fingers, it should be a little more—but not much.

The Humidity of the Atmosphere.—The "relative humidity" of the air of the class-room can be ascertained by consulting a table after finding out the difference between the readings of a dry and a wet bulb thermometer. The best way to find the reading of the wet bulb is as follows: Tie a loose piece of linen round the bulb of a thermometer and wet it thoroughly. Whirl the thermometer rapidly round by means of a piece of stout cord to which it has been secured. The drier the air the more rapid will be the evaporation from the linen, and consequently the greater will be the lowering of the temperature shown by the wet bulb as compared with the dry.

At ordinary temperatures, the capacity of air to absorb moisture is doubled with an increase of 19° F. Thus if the

outside air is at 42° F. and has a relative humidity of 75 per cent., this will be reduced to 37·5 per cent. if the air is heated to 61° F. As air tends to absorb moisture till it is saturated, such relatively dry air will take up moisture from everything it comes in contact with that will yield it, such as the skin, the lining membrane of the nose, mouth and throat, and the lungs of the pupils. In this way it produces a feeling of cold, and an increased tendency to catarrhal troubles. Between 56° and 60° F. the difference between the readings of the dry and wet bulbs should not be more than 9° F.

E. THE SCHOOL PLAN

The rooms of a school may be arranged in various ways. For a good many years the favorite plan in Great Britain has been to arrange the class-rooms *round a central hall.* The advantages claimed for this type of school are—compactness, ease of supervision, ease of access to the hall from all class-rooms. The compactness facilitates mechanical ventilation—an undoubted advantage in the eyes of those to whom mechanical ventilation is an end and not a means.

There are several objections to schools of this type. They often have to be placed in such a way that many of the rooms get no sun. Cross-ventilation for many of the rooms must be into the assembly hall. This is unsatisfactory, not only from the point of view of the ventilation of the class-rooms, but because the foul air from the class-rooms contaminates the air of the hall which is used by children for drill, singing, or games. Moreover, the proximity of the hall to the class-rooms is a drawback from the point of view of noise. Some of these drawbacks can be diminished, though not removed, by mechanical ventilation, and the disposition of the class-rooms round three sides of the hall only.

A plan of a central hall school is shown in Fig. 45. This particular plan is chosen in order to point out certain faults. Rooms 2 and 6 seat badly with reference to the light. As children must on no account be seated facing the windows, the chief lighting will come from their right if they sit facing the door. If they sit in the only other possible

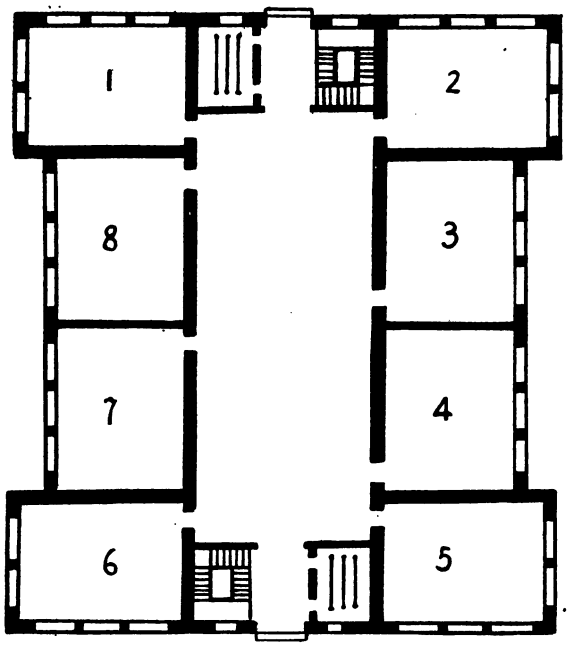


FIG. 45. Central Hall School, with class-rooms all round hall.

way they will be worse off still, as they will be in their own light. The light from behind will overpower that from the left, except for the children sitting near the left-hand windows.

The Staffordshire type of school is shown in Fig. 46. There is a semi-detached hall, and the class-rooms open

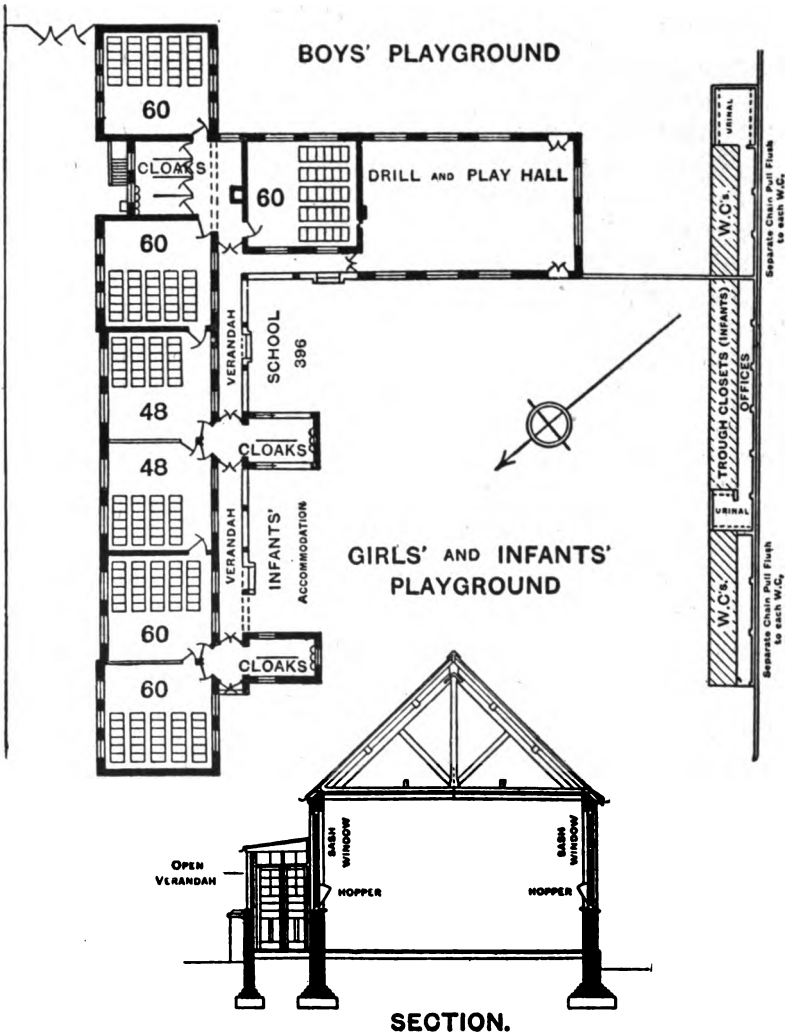


FIG. 46. Staffordshire type of school (Darlaston). (From Dr. Lyster's *School Hygiene* [W. B. Clive]. This illustration shows the plan of the first school of this type. Some details are criticized in the text, but the general principle is excellent.

onto a veranda. The elevation shows that the veranda is not so high as the class-room. There is thus free cross-ventilation into the open air, the windows being provided with large hoppers below and sash-openings above. From the fresh air point of view, this type of school is decidedly preferable to the central hall type. Moreover, only a single class in the plan is liable to be disturbed by noise from the hall. Even this might have been avoided; for example, by placing one of the cloak-rooms between this class-room and the hall. Some other faults will be noticed in the plan. In several class-rooms the principal light comes from the right. The exits from some of the class-rooms are faulty, being so arranged that two streams of children from contiguous class-rooms might meet and block each other if there were an alarm of fire. The exposure, also, is northeast, so the class-rooms cannot get much sun. A better exposure would have been obtained by placing the veranda at the other side, though, with the school in the same position, this would have exposed the class-rooms to the noise of the playground—an important consideration if some classes are at lessons while others are at play.

Another example of this type of school is shown in Fig. 47. This is a supplementary school, recently erected by the Edinburgh School Board. It has two stories with accommodation for 960 pupils in twenty-four class-rooms, each of which is seated for forty pupils, with an allowance of 14 square feet of floor space for each pupil. There is left-hand lighting in each class-room, and cross-ventilation through the corridor, and by means of air-shafts leading directly to the exterior. Each class-room has hopper windows and a fireplace. There is also a low-pressure hot-water system, heated by the class-room fires.

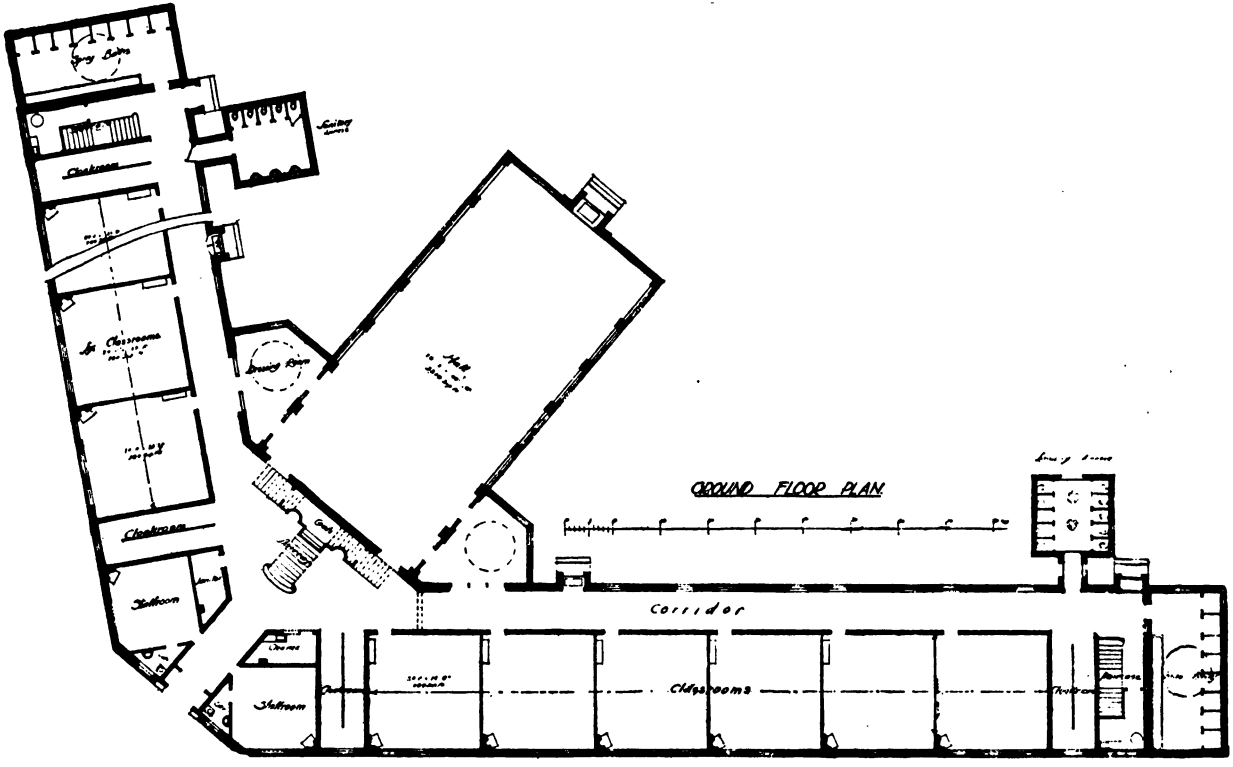


FIG. 47. Tynecastle School, Edinburgh. Staffordshire Type.

F. THE PLAYGROUND

Every school should have ample playground accommodation. The Board of Education Code fixes the minimum area at 30 square feet per scholar. "In the case of a mixed school of large size, playgrounds should be separate for boys and girls. All playgrounds should be fairly square, properly levelled, drained, enclosed, and fitted with some simple appliances." Probably the best material for the playground is asphalt, which can be made level and kept clean; but it is hard for falling, and does not allow the children to use their limbs freely in running, in case of a slip. The playground should be surrounded by a low wall, surmounted by a railing, so that there may be free access to wind and sun. Every playground should have plants growing in it. There is no reason, even in a big town, why the playground should be a wilderness of asphalt, shut in by a high wall, though such dreary barrack yards are still constructed, at considerable expense to the ratepayers. At the sunny side of the playground a few feet should be spared for a bed, in which some hardy flowers and creepers can be grown. This should be looked after by the children themselves, who will be more interested in rapidly growing annuals, which can be changed every season, than by ivy and evergreens, which change but little. There should also be a few trees, not so near as to shade the school-room windows.

At one side of the playground there should be a covered portion in which the children can play in wet weather. This should not be a narrow, uninviting shed, but should be a play-room constructed in such a way as to be utilizable for open-air classes. Sometimes schools are built in such a way that part of the structure is supported upon pillars about 8 to 9 feet high, a sort of cave being thus left underneath the building. The shelter obtained in this way is

apt to be rather a dismal one, though an attractive play-room, fully open on one side, might easily be made in such a position if the architect gave his mind to it.

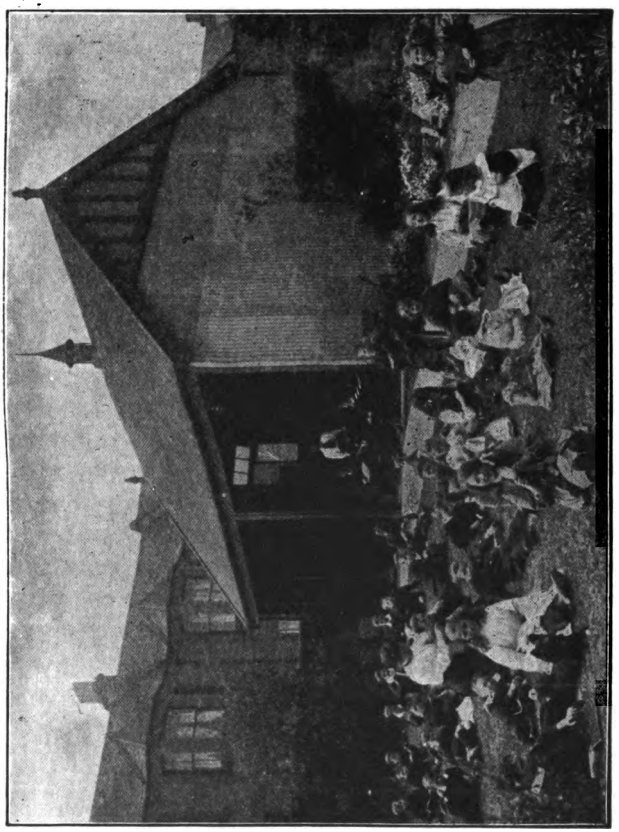


FIG. 48. An open-air class-room (Edinburgh School Board).

Where sufficient ground cannot be obtained for the playground, the roof may be utilized. Roof playgrounds are common in America. The playground is not only securely guarded round the sides, but is partially or com-

pletely covered over. There may also be movable partitions, by which it may be divided into portions in which classes can be held.

But an ideal school would have something more than an asphalt playground, even with trees and flower-beds. It would have access to a grass field or meadow, for there

FIG. 49. A town garden among tenements.

is, of course, no better surface for play than good turf in fine weather. Part of the field should be laid out as a school garden, for gardening possesses all the educational advantages and correlations of "Nature study," and, in addition, affords outdoor physical exercise. Even town schools can often obtain the use of ground. In Edinburgh in recent years several pieces of waste ground which had

lain derelict among tenements for generations have been converted into school gardens. Yet it is a curious thing that in this same town people pay fees to send their children to schools without playgrounds, where pupils are kept indoors from the time they arrive in the morning till four in the afternoon, though these same schools are within a stone's throw of public and semi-public parks and gardens.

The Utilization of Playgrounds.—Another curious anomaly is that in many towns there are excellent school playgrounds which children are locked out of except during school hours. This reminds one of the child's definition of grass as "what you have to keep off." Now, play is a hygienic necessity for children, a necessity for their physical, mental, and moral welfare. If no place is provided for the wholesome exercise of their innate impulses and instincts, they are certain, many of them, to get into mischief in the artificial surroundings of town life. Far more juvenile crime results from the thwarting or misdirection of natural instincts than from original sin. It is claimed that the provision of playgrounds in certain districts of New York resulted in a decrease of juvenile crime by 60 per cent. The school playgrounds belong to the community. It is surely folly to keep them locked up in districts where there is no other place to play but the streets.

The Code recommends that playgrounds should be fitted with some simple appliances. What should such appliances be? An American writer, Dr. McKenzie,* recommends the following equipment for a small playground for little children:

1. Ten-foot double swing frame and two swings.
2. Six-foot swings with canvas scoops for little children to swing or sleep in.

* *Exercise in Education and Medicine*, by R. Tait McKenzie, B.A., M.D. (Saunders).

3. Two or three see-saws with 14-foot boards.

4. Sand-box with one or two loads of fine white sand.

5. Awning protection against the sun, and shelter for rainy weather.

Also building blocks, sand buckets, and games.

Dr. McKenzie gives plans and illustrations of playgrounds for older children, provided with swings, ladders, see-saws, giant-strides, vaulting-horses, jumping pits, a wading pool, a running track, and areas for tennis, baseball, and quoits.

The sand-pile is a very favorite "appliance" in Germany and America, and is coming into use in Great Britain. The educational value of the sand-table is recognized in the kindergarten. The appeal of the larger sand-pile to the instincts of childhood is shown by the way in which a load of builder's sand, left unguarded, attracts all the young children in the neighborhood. The objection to the sand-heap is that it is liable to contamination, and soon becomes dirty, especially in town. The sand, therefore, must be thoroughly washed at frequent intervals. For this purpose it is not sufficient to water the sand freely with a hose, for sand is an excellent filter, and water will pass through it as clean as it enters. The sand must be stirred up with a spade while the water is turned upon it, the dirty water being run off as the sand sinks. The sand should not be very fine, as fine sand is apt to blow about, and may get into children's eyes.

Swings are not only highly attractive to children, but afford good exercise. But high swings should not be used by young children without supervision, nor should the ordinary wooden seat be permitted. The writer has seen several cases of fractured skull due to the impact of a swing seat. There is more danger of this accident than there is of a child letting go. A seat of padded rope is much safer, and is comfortable enough. A child getting

in the way of a swing with such a seat may be knocked down, but runs little risk of a fractured skull.

Jumping pits, for long and high jumps, are an excellent feature for school playgrounds, and require very little room.

It is not necessary to enter upon any discussion of the question whether games should be organized. That problem is educational rather than hygienic. It must suffice to say, on the one hand, that if play is to be free, it must not be subject to outside interference; and, on the other, that a certain amount of supervision and teaching is necessary. Strong as the play instinct is, the plays of children left entirely to themselves are often extraordinarily inane. In past generations children always were taught to play by older children on the village greens. In present circumstances instruction is just as necessary for play as it is for the folk-dancing now being revived.

The problem how to obtain enough of ground for school activities should not be allowed to obscure another—how to make the utmost use of the ground available. Mention has already been made of playground classes. A further extension of this idea has found practical expression in the playground camp. Miss Sewell* has described three successful experiments of this kind. Beds, made by the boys, consisted of wooden trestles, and two lengths of iron piping passed through a bottomless sack. Bedding, made by the girls, consisted of a sleeping-bag and blanket, and a hay pillow. In fifteen minutes a playground could be converted into an open-air dormitory. Canvas coverings were devised for wet weather. The school lavatories and cloak-rooms were used for dressing. Supervision was undertaken by voluntary help.

* *School Hygiene*, December, 1911.

ADDENDUM

ACCIDENTS AND EMERGENCIES

BEYOND giving first-aid, a teacher will be wise not to undertake the responsibility of treating either illness or injury. Every teacher should attend an ambulance course. Only a very brief indication can be given here of the first-aid treatment for a few common accidents.

An **Emergency Box** should be kept in every school. It should contain at least a few bandages, boracic lint, sticking-plaster, boracic lotion, olive oil, smelling salts, and wood or mill-board suitable for making splints.

Bleeding.—(1) Apply *firm pressure* with a pad; and (2) *elevate* the bleeding part. A tourniquet ought not to be used unless it is really necessary, which it very rarely is. A tourniquet may be improvised by tying a bandage round the limb between the wound and the trunk, and twisting *tightly* by means of a stick.

Cuts.—(1) *Slight.*—Clean carefully with boracic lotion, and apply sticking-plaster.

(2) *Severe.*—Wash with boracic lotion, and bind a piece of wet boracic lint in position until the wound can be dressed by a doctor.

Bites of Animals.—Bind a piece of wet boracic lint upon the bite, and have the injury treated by a doctor without delay.

Nose Bleeding.—Make the child sit up with head thrown back. Apply cold to nape of neck. The head must not be bent down over a basin.

Bruises, Sprains, Strains.—Apply cold water cloths at once.

Clothes catching Fire.—Catch the child in any rug, coat, or cloak at hand, lay her down, and smother the flames as quickly as possible; or throw a pail of water over her—whichever can be done most quickly.

Burns and Scalds.—Apply lint soaked in oil or, better, a mixture of oil and lime-water. In bad cases carry the child home, or to a hospital, or get a doctor at once.

Fainting.—Let the child lie with head low. Loosen clothes. Open windows. Sprinkle cold water on face. Hold smelling salts to nostrils—not too near.

Epileptic Fits.—Place the child so that he cannot injure himself. Loosen clothes. Place a piece of wood between the teeth to prevent tongue being bitten. *On no account* use a cork for this purpose, as it might be bitten through and cause choking.

Poisoning.—(1) By acids—give alkali (*e.g.*, chalk and water).

(2) By alkalies—give acid (*e.g.*, vinegar and water).

(3) Other poisons, such as laburnum flowers, berries of deadly nightshade, etc.—give an emetic (mustard and water), unless the child is already vomiting freely. Get a doctor as quickly as possible.

Fractures and Dislocations.—Make the child comfortable until the doctor arrives. If the child must be moved, immobilize the injured limb by binding splints on it so as to fix the joints above and below the injury. The legs may be bound together, or the arm to the side. If the collar-bone is broken, no splint is necessary, but the arm should be supported by a sling. If a leg is broken, the child may be carefully moved on a stretcher.

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